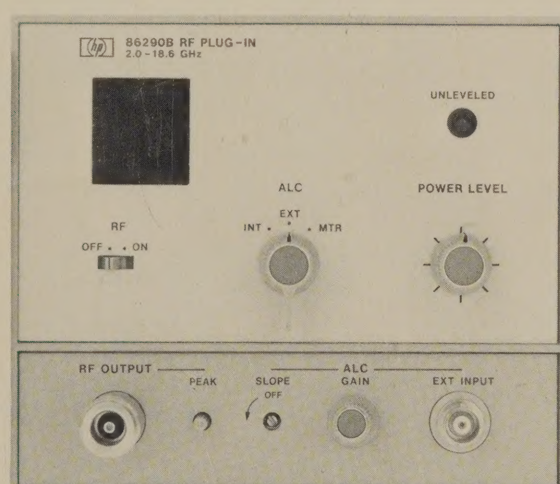
OPERATING AND SERVICE MANUAL

HP 86290B RF PLUG-IN

2.0 — 18.6 GHz



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CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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EXCLUSIVE REMEDIES

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ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

HP 86290B
RF PLUG-IN
(Including Options 004 and 005)

SERIAL NUMBERS

This manual applies directly to HP Model 86290B RF Plug-In having serial number prefix 2227A.

With changes described in Section VII, this manual also applies to instruments with serial numbers prefixed 1704A, 1727A, 1737A, 1742A, 1807A, 1840A, 1847A, 1852A, 1904A, 1908A, 1933A, 1952A, 2021A, 2034A, 2046A, 2109A, 2138A, and 2217A.

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

MANUAL PART NUMBER: 86290-90074
Microfiche Part Number: 86290-90076

Printed: JULY 1984

HEWLETT PACKARD

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TABLES

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

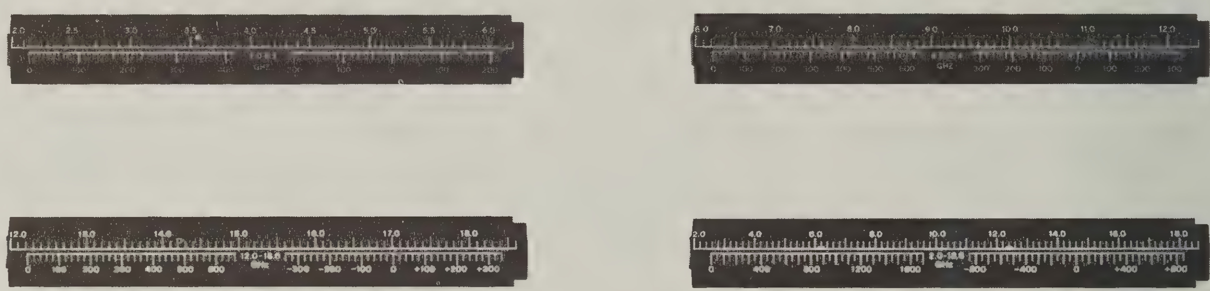
SERVICING

WARNING

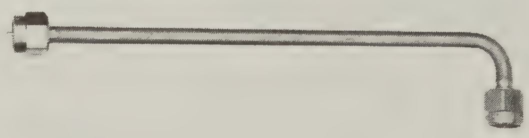
Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

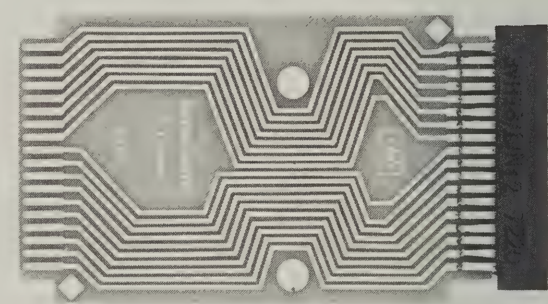
86290B



SCALES FOR 8620C*



RF TEST CABLE*



EXTENDER BOARD*

*NOTE: See paragraph 1-24 for part number information

Figure 1-1. Model 86290B RF Plug-In with Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 86290B RF Plug-In. Figure 1-1 shows the instrument and accessories supplied. This section covers instrument identification, description, options, accessories, specifications, and other basic information.

1-3. This manual is divided into eight sections which provide information as follows:

a. SECTION I, GENERAL INFORMATION, contains the instrument description and specifications as well as the accessory and recommended test equipment list.

b. SECTION II, INSTALLATION, contains information relative to receiving inspection, preparation for use, mounting, packing, and shipping.

c. SECTION III, OPERATION, contains operating instructions for the instrument.

d. SECTION IV, PERFORMANCE TESTS, contains information required to verify that instrument performance is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, contains information required to properly adjust and align the instrument after repair.

f. SECTION VI, REPLACEABLE PARTS, contains information required to order all parts and assemblies.

g. SECTION VII, MANUAL CHANGES, contains backdating information to make this manual compatible with earlier equipment configurations.

h. SECTION VIII, SERVICE, contains descriptions of the circuits, schematic diagrams, parts location diagrams, and troubleshooting procedures to aid the user in maintaining the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. The Supplement is a copy of the first three sections of this manual, and should be kept with the instrument for use by the operator. Additional copies of the Operating Information Supplement can be ordered through your nearest Hewlett-Packard office. The part number is listed on the title page.

1-5. Also listed on the title page of this manual is a Microfiche part number. This number can be used to order 4x6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-6. SPECIFICATIONS

1-7. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

1-8. Safety Considerations

1-9. This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of Safety Considerations precedes Section I of this manual.

1-10. INSTRUMENTS COVERED BY MANUAL

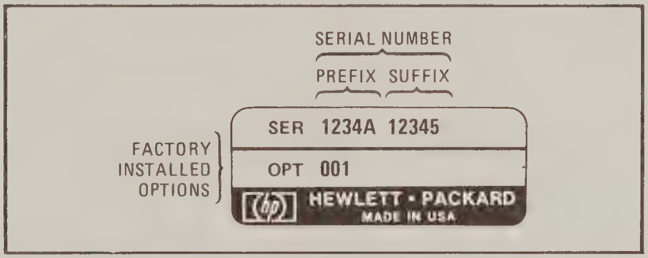


Figure 1-2. Serial Number Plate

1-11. Attached to the instrument is a serial number plate (Figure 1-2). The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-12. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains 'change information' that explains how to adapt the manual to the newer instrument.

1-13. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-14. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-15. DESCRIPTION

1-16. The HP Model 86290B is designed as a Plug-In for the 8620C mainframe. The mainframe and 86290B Plug-In make up a solid-state sweep signal source with a frequency range of 2.0 to 18.6 GHz. The frequency range is swept in either one continuous band or in three bands. In single band operation, Band 1 sweeps 2.0 to 6.2 GHz, Band 2 sweeps 6.0 to 12.4 GHz, and Band 3 sweeps 12.0 to 18.6 GHz. When Band 4 is selected on the mainframe, the full frequency range of 2.0 to 18.6 GHz is swept continuously. The fundamental frequency of 2.0 to 6.2 GHz is generated by a YIG Tuned Oscillator (YTO). A YTO test signal (typically − 10 dBm) is available at the rear panel AUX OUT connector. A YIG Tuned Multiplier (YTM) provides the frequency range from 6.0 to 18.6 GHz.

1-17. The RF output of the instrument is controlled by the front panel POWER LEVEL control. Power can be leveled, externally or internally, across the band using a conventional power sampling and feedback technique. The automatic level control (ALC) switch selects the mode of leveling either internal (INT), external crystal (EXT), or power meter (MTR). A front panel EXT INPUT connector and ALC GAIN control are provided to use with an external leveling loop. When the UNLEVELED light is on, it indicates that the leveling loop is open over a portion of the swept band. BNC connectors on the rear panel allow for external GM signal inputs, a 1 V/GHz frequency reference voltage output, and a SEQ SYNC timing signal.

1-18. Options for the Model 86290B RF Plug-In are available to (1) substitute a rear-panel RF OUTPUT connector and route the EXT INPUT connector to the rear panel and (2) provide a front-panel or rear-panel APC-7 RF OUTPUT connector.

1-19. OPTION 004

1-20. The 86290B Option 004 has the RF OUTPUT and ALC EXT INPUT connectors mounted on the rear panel instead of the front panel. Installation information may be obtained from the nearest Hewlett-Packard Field Service Center. Installation of the Option 004 requires the parts listed in Table 1-3.

1-21. OPTION 005

1-22. The standard 86290B RF Plug-In uses a Type-N RF OUTPUT connector. The 86290B Option 005 provides an APC-7 OUTPUT connector. See Table 1-3 for parts required to install Option 005.

1-23. ACCESSORIES SUPPLIED

1-24. Figure 1-1 shows the HP Model 86290B RF Plug-In, the four scales to be mounted in the mainframe, the RF Test Cable (HP Part No. 86290-20032) for testing and troubleshooting the RF Section, and an extender board (HP Part No. 86290-60020) to extend printed-circuit boards for troubleshooting. The four scales supplied are as follows:
2.0 to 6.2 GHz, HP Part No. 86290-00014;
6.0 to 12.4 GHz, HP Part No. 86290-00015;
12.0 to 18.6 GHz, HP Part No. 86290-00040;
2.0 to 18.6 GHz HP Part No. 86290-00041.

1-25. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-26. To have a complete operating sweep oscillator unit, the Model 86290B RF Plug-In must be installed in an 8620C mainframe.

NOTE

All 86290B operation and maintenance procedures in this manual are set up using the HP Model 8620C mainframe. The 86290B will not operate with an 8620A or 8620B mainframe.

1-27. EQUIPMENT AVAILABLE

1-28. Service Accessories

1-29. A service accessories package for the 86290B Plug-In is available for convenience in aligning and troubleshooting the mainframe and RF Plug-In. The Service Accessories Package as shown in Figure 1-3, contains a plug-in extender cable, two service boards, and an adjustment tool. The package may be obtained from Hewlett-Packard by ordering HP Part. No. 08620-60124.

1-30. Reversing Extender Board

1-31. A reversing extender board (Figure 1-4) is available for adjusting and troubleshooting when two circuit boards are extended at the same time. The reversing extender board is especially convenient when two adjacent boards are extended. This allows simultaneous access to the components of both boards. One board is extended on the reversing extender board with a second board on the standard extender board (Figure 1-1). The board may be obtained from Hewlett-Packard by ordering Part No. 86290-60033.

1-32. RF Section 36-Pin Extender

1-33. A 36-pin extender is available for extending the RF Section approximately 1 inch. This allows easy access to components located near the front of the instrument. This extender, shown in Figure 1-5, may be obtained from Hewlett-Packard by ordering Part No. 08621-60056.

1-34. Model 8755C Swept Amplitude Analyzer

1-35. The Model 8620C/86290B Sweeper is compatible with the Hewlett-Packard Model 8755C Swept Amplitude Analyzer. For all swept amplitude measurements, the 27.8 kHz square wave modulation is applied directly to the 8620C rear-panel EXT AM connector. This eliminates the need for an external modulator, thus providing maximum available power to a test setup.

1-36. Power Meters and Crystal Detectors

1-37. The Hewlett-Packard Model 432A Power Meter may be used for external leveling of the Model 86290B Plug-In RF Output Power. Externally leveled power is also available using an HP 8470B Crystal Detector. Section III contains detailed instructions for using the external power leveling systems.

1-38. Model 8410B/8411A Network Analyzer

1-39. The Model 8620C/86290B sweeper provides multi-octave phase/gain measurement capability with the Hewlett-Packard Model 8410B Network Analyzer System. The combination of the Model 8410B Network Analyzer, the Model 8411A Frequency Converter, and an appropriate display plug-in forms a phase meter and a ratio meter for direct phase and amplitude ratio measurement on RF voltages. These measurements can be made on single frequencies and on swept frequencies from 2.0 to 18.6 GHz. The interfacing between the 8410B and 8620C/86290B sweeper permits the 8410B to phase lock over the 2.0 to 18.6 GHz range. Sweep timing pulses for the 8410B Network Analyzer are available at the rear-panel SEQ SYNC connector.

1-40. RECOMMENDED TEST EQUIPMENT

1-41. Equipment required to maintain the Model 86290B is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specification listed in the table.

Table 1-1. Specifications for 86290B Installed in 8620C (1 of 2)

SPECIFICATIONS[1]	Band 1	Band 2	Band 3	Band 4
FREQUENCY				
Range:	2.0–6.2 GHz	6.0–12.4 GHz	12.0–18.6 GHz	2.0–18.6 GHz
Accuracy (at 25°C):[2]				
CW Mode[3] (or Sweep Time >0.1 sec with FM switch in PL or FM):	±20 MHz	±30 MHz	±30 MHz	±80 MHz
All sweep modes:	±30 MHz	±40 MHz	±40 MHz	±80 MHz
Marker:	±30 MHz	±30 MHz	±30 MHz	±80 MHz
Stability				
Temperature Change:	±.05 MHz/°C	±1.0 MHz/°C	±1.5 MHz/°C	±2.0 MHz/C°
10% Line Voltage Change:	±100 kHz	±100 kHz	±100 kHz	±100 kHz
10 dB Power Change from Specified Maximum Power:	±600 kHz	±1.2 MHz	±1.8 MHz	±1.8 MHz
3:1 Load SWR, all phases:	±100 kHz	±200 kHz	±300 kHz	±300 kHz
Residual FM (in 10 kHz bandwidth; FM-NORM-PL switch in NORM position): CW Mode:	<10 kHz peak	<20 kHz peak	<30 kHz peak	<30 kHz peak
POWER OUTPUT				
Maximum Leveled Power (25°C):[8]	>+10 dBm (10 mW)	>+10 dBm (10 mW)	>+10 dBm (10 mW)	>+10 dBm (10 mW)
Power Variations (at specified maximum power):				
Internally Leveled:[9]	<±0.7 dB	<±0.7 dB	<±0.8 dB	<±0.9 dB
Externally Leveled[4]				
Crystal Detector:	<±0.15 dB	<±0.15 dB	<±0.15 dB	<±0.15 dB
Power Meter:[5]	<±0.15 dB	<±0.15 dB	<±0.15 dB	<±0.15 dB
Spurious Signals (below fundamental at specified maximum power, 2–18.6 GHz):				
Harmonically Related Signals:	>25 dB	>25 dB	>25 dB	>25 dB
Nonharmonics:	>50 dB	>50 dB	>50 dB	>50 dB
Residual AM (100 kHz bandwidth; below fundamental at specified maximum power):	>55 dB	>55 dB	>55 dB	>55 dB
Source SWR (50Ω Nominal Impedance, 2–18 GHz): Internally Leveled:	<1.9:1	<1.9:1	<1.9:1	<1.9:1
MODULATION				
External FM (Maximum Deviations for Modulation Frequencies):				
DC to 100 Hz:	±75 MHz	±75 MHz	±75 MHz	±75 MHz
100 Hz to 2 MHz:	±5 MHz	±5 MHz	±5 MHz	±5 MHz

MANUAL CHANGES

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

MANUAL IDENTIFICATION

Model Number: 86290B/C
Date Printed: July 1984
Part Number: 86290-90074

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement, make all ERRATA corrections and all appropriate serial number related changes indicated in the tables below.

▶ = NEW ITEM

86290B

	Serial Prefix or Number	Make Manual Changes
	2431A	1
▶	2534A	1 and 2

86290C

	Serial Prefix or Number	Make Manual Changes
	2432A	1
▶	2533A	1 and 2

4 SEPTEMBER 1985
10 pages

HEWLETT PACKARD

Printed in U.S.A.

UPDATES APPLICABLE TO ALL SERIAL NUMBERS

Page 1-2, Paragraph 1-18:
Change paragraph 1-18 to read: "Option 004 substitutes a rear panel RF OUTPUT connector and routes the EXT INPUT connector to the rear panel.

Page 1-2, Paragraphs 1-21 and 1-22:
Change paragraphs 1-21 and 1-22 to read:

1-21. RF OUTPUT Connector

1-22. The standard HP 86290B RF plug-in uses a Type N RF OUTPUT connector.

Page 1-2, Paragraph 1-24:
Add the following note after paragraph 1-24:

NOTE

The RF cable is already mounted on the left-hand side of the RF plug-in (as viewed from the front). The extender board is attached to the bottom of the RF plug-in and need not be removed for plug-in installaltion.

Page 1-4, Table 1-1:
Change specification for "**Stability**: 10 dB Power Change from Specified Maximum Power:" as follows:
Band 1, 1 MHz
Band 2, 2 MHz
Band 3, 3 MHz
Band 4, 3 MHz

Add the following note under **POWER OUTPUT**:
"Refer to Table 4-14 for Option 004 power specifications."

Page 1-6, Table 1-2:
Under **Options**: Delete reference to Option 005.

Page 1-7, Table 1-3:
Delete the Option 005 information.

Page 3-5, Figure 3-2:
In Item 9, delete "(APC-7® for Option 005)." (**APC-7® is a U.S. registered trademeark of the Bunker Ramo Corporation**).

Page 3-9, Figure 3-5:
In Item 4, delete "(APC-7® for Option 005)."

Page 4-30, Paragraph 4-15:
Step d: Change "FULL SWEEP" to "ΔF."

Page 4-34, Test Record Card section 4-10:
Add the following note:
"Refer to Table 4-14 for Option 004 power specifications."

Page 5-43, Adjustment 5-27:
Change Step i to read: "Adjust A1R7 LO LEVEL CLAMP for **0 dBm** at 18.6 GHz."

UPDATES APPLICABLE TO ALL SERIAL NUMBERS (Cont'd)

Page 6-5, Figure 6-1:
Delete the exploded view of the APC-7 connector along with the associated MP1 and MP2 call-outs. Delete the reference to Option 005.
Delete the part descriptions to each of the following:
Second reference to J1, Part Number 86290-60007.
Second reference to J1MP1, Part Number 1250-0909.
Second reference to J1MP2, Part Number 1250-0816.

Page 6-21, Table 6-2:
Change A1C4 to HP and Mfr. Part Number 0160-2306, CD 3, CAPACITOR-FXD 27 PF ±5% 300VDC MICA.
Change A1 CR20 and CR21 to HP Part Number 1901-0050, CD 3, DIODE-SWITCHING 80V 200 MA 2 NS, 02237, FDH6308.
Change A1Q7 to HP Part Number 1853-0451, CD 5, TRANSISTOR PNP 2N3799 SI TO-18 PD=360 MW, 03406, 2N3799.

Page 6-23, Table 6-2:
Change A1W1 to HP and Mfr. Part Number 0811-3587, CD 5, RESISTOR ZERO OHMS 22AWG LEAD DIA.

Page 6-25, Table 6-2:
Change A2U1 and U2 to HP and Mfr. Part Number 1826-1058, CD 3, IC OP-AMP.

Page 6-26, Table 6-2:
Change A3Q4 and Q5 to HP Part Number 1853-0044, CD 2, TRANSISTOR 2N2716 SI TO-5, 01973, 2N2716.
Add the attached portion of the A3 parts list to the end of page 6-26, Table 6-2.

Page 6-27, Table 6-2:
Change A3U1 and U2 to HP and Mfr. Part Number 1826-1058, CD 3, IC OP-AMP.

Page 6-31, Table 6-2:
Change A5U1 and U2 to HP and Mfr. Part Number 1826-1058, CD 3, IC OP-AMP.

Page 6-37, Table 6-2:
Change the check digit of A11 to 0.
Change A12 description as follows: "A12, 86290-60132, CD 1, QTY 1, YTM REPLACEMENT KIT, 28480, 86290-60132.
Add A12 HP and Mfr. Part Number 86290-60133, CD 2, QTY 1, RESTORED YTM REPLACEMENT KIT FOR 86290-60132.
Change the check digit of AT1 to 0.

Page 8-11/8-12, Figure 8-6 (2 of 2):
Show W8 between AT1J2 and A12J1. W8P1 goes to A12J1 and W8P2 goes to AT1J2.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R20	2100-2031	7	5	RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN	73138	82PR50K
A3R21	2100-2031	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN	73138	82PR50K
A3R22	0698-8491	8	1	RESISTOR 17.6K .1% .1W F TC=0+4	28480	0698-8491
A3R23	2100-2031	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN	73138	82PR50K
A3R24	2100-2031	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN	73138	82PR50K
A3R25	2100-0636	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 20 TRN	28480	2100-0636
A3R26	2100-0637	5	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 20 TRN	28480	2100-0637
A3R27	2100-2497	9		RESISTOR-TRMR 2K 10% C TOP-ADJ 1 TRN	73138	82PR2K
A3R28	2100-2655	1		RESISTOR-TRMR 100K 10% C TOP-ADJ 1 TRN	73138	82PR100K
A3R29*	0757-0475	8	1	RESISTOR 274K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2743-F
A3R30*	0698-8489	4	1	RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A3R31	0698-8478	1	1	RESISTOR 3.52K .1% .1W F TC=0+4	28480	0698-8478
A3R32	0698-6405	0	1	RESISTOR 5.1K .1% .1W F TC=0+4	28480	0698-6405
A3R33	0698-8487	2	1	RESISTOR 12.1K .1% .1W F TC=0+4	28480	0698-8487
A3R34	2100-2031	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN	28480	82PR50K

See introduction to this section for ordering information *Indicates Factory selected Value

▶ CHANGE 1

Page 6-21, Table 6-2:

Change the HP and Mfr. Part Number of the A1 ALC assembly to 86290-60136. Order only the replacement kit, HP Part Number 86290-60072, CD 8.

Page 6-23, Table 6-2:

Delete A1R88.

Add A1R89, HP Part Number 0698-7272, CD 1, RESISTOR 31.6K 1% .125W.

Page 8-17, Figure 8-9:

If documenting an HP 86290B with a serial prefix of 2534A and above, or an HP 86290C with a serial prefix number of 2533A and above; do not implement this entry:

Change the component location diagram as follows:

Move CR20 to where R88 is currently shown (same anode/cathode orientation)

(R88 no longer exists.) Add A1R89 to where CR20 was originally located.

Page 8-17, Figure 8-10:

In the lower left corner of schematic Block H, add a 3160 Ohm resistor from the junction of CR18 and CR21 to ground. On the left side of schematic Block G, delete R88. Show the cathode of CR20 going directly to Pin 3 of U2.

Page 8-17, Figure 8-10:

If documenting an HP 86290B with a serial prefix number of 2534A and above, or an HP 86290C with a serial prefix number of 2533A and above; do not implement this entry:

Change the part number of the A1 ALC assembly to 86290-60136.

▶ CHANGE 2

Page 6-21, Table 6-2:
Change the HP and Mfr. Part Number of the A1 ALC assembly to 86290-60137. Order only the replacement kit, HP Part Number 86290-60072, CD 8.

Page 8-17, Figure 8-9:
In the upper left portion of the component diagram, delete R88 and show R89 in its place. In the bottom center of the diagram, add CR3 between CR2 and CR4 (with the same anode-cathode orientation).

Page 8-17, Figure 8-10:
Change the part number of A1 ALC assembly to 86290-60137.

Table 1-1. Specifications for 86290B Installed in 8620C (2 of 2)

SPECIFICATIONS[1]				
	Band 1	**Band 2**	**Band 3**	**Band 4**
MODULATION (cont'd)				
Sensitivity (nominal):[6]				
FM Mode (FM-NORM-PL switch in FM position):	−20 MHz/V	−20 MHz/V	−20 MHz/V	−20 MHz/V
Phase-Lock Mode (FM-NORM-PL switch in PL position):	−6 MHz/V	−6 MHz/V	−6 MHz/V	−6 MHz/V
External AM (at specified maximum power):[7]				
ON/OFF Ratio:	>30 dB	>30 dB	>30 dB	>30 dB
Symmetry:	40/60	40/60	40/60	40/60
Attenuation for +5V Input:	30 dB	30 dB	30 dB	30 dB
Internal AM (below specified maximum power):				
1 kHz squarewave ON/OFF Ratio:	>25 dB	>25 dB	>25 dB	>25 dB
RF Blanking ON/OFF Ratio:	>30 dB	>30 dB	>30 dB	>30 dB

[1]All specifications are at 25°C. Allow 30 minutes warm-up time.

[2]See also the Supplemental Characteristics, Table 1-2.

[3]Approach desired frequency from low-frequency end of band.

[4]Excluding coupler and detector variation.

[5]Use HP Model 432A Power Meter. Sweep duration >10 seconds.

[6]A positive input voltage decreases frequency.

[7]Specific requirements for compatibility with HP 8755C, ±6V 27.8 kHz square wave MODULATOR DRIVE output connected to external AM input.

[8]Subtract 0.5 dB for Option 004.

[9]Add 0.1 dB for Option 004.

Table 1-2. Supplemental Characteristics for 86290B Installed in 8620C

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

	Band 1	Band 2	Band 3	Band 4
FREQUENCY **Linearity:** (Correlation between frequency and SWEEP OUT voltage in MANUAL mode): Sweep Time >0.1 sec:	±8 MHz	±8 MHz	±8 MHz	±30 MHz
Drift: (10 minute period after 30 minute warm-up):	±300 kHz	±600 kHz	±900 kHz	±900 kHz
POWER OUTPUT **Power Level:** Stability with temperature change:	±0.1 dB/°C	±0.1 dB/°C	±0.1 dB/°C	±0.1 dB/°C
Control range while maintaining 40/60 symmetry of internal 1 kHz squarewave:	>10 dB	>10 dB	>10 dB	>10 dB
MODULATION **External AM** (at specified maximum power):	<1.5 μsec	<1.5 μsec	<1.5 μsec	<1.5 μsec
Internal AM Sweep Time (at maximum sweep speed):	10 msec	10 msec	10 msec	10 msec
CW Remote Program Settling time: FM switch in PL or FM:	5 msec	5 msec	5 msec	10 msec

GENERAL

Crystal Input: Approximately 50 to 750 mV for specified leveling at rated output; for use with negative polarity detectors such as HP Model 780 series Directional Detectors, and HP Models 8470 and 8472 series Crystal Detectors.

Switch Points (Band 4 selected): Broadband switch points are at 6.2 and 12.4 GHz. Frequency overlap is nominally 0 to 20 MHz at switch points.

Frequency Reference Output: Typically 1V/GHz ±0.035V; available at rear panel FREQ REF connector.

Fundamental Oscillator: YIG Tuned 2.0 to 6.2 GHz Oscillator. Oscillator signal available at rear panel AUX OUT connector, typically −10 dBm.

Net Weight: 9.6 pounds (4.4 kg).

Shipping Weight: 13 pounds (5.9 kg).

Dimensions: Height: 5 inches (12.7 cm); Width: 5$\frac{3}{16}$ inches (14.7 cm); Depth: 12 inches (30.5 cm).

Options:
Option 004: Rear Panel RF Output.
Option 005: APC-7 RF Output Connector.

Table 1-3. Parts Required for 86290B Options

Option	Reference Designator	HP Part No.	Description
004		86290-00002	Panel: Front Lower
		86290-00023	Cover: Rear Panel
	W11	86290-20031	RF Cable: RF Coupler to Output
	J9	86290-60005	Connector: Rear RF Output
	J10	1250-0118	Connector: Rear EXT ALC INPUT
005	J1	86290-60007	Connector: APC-7

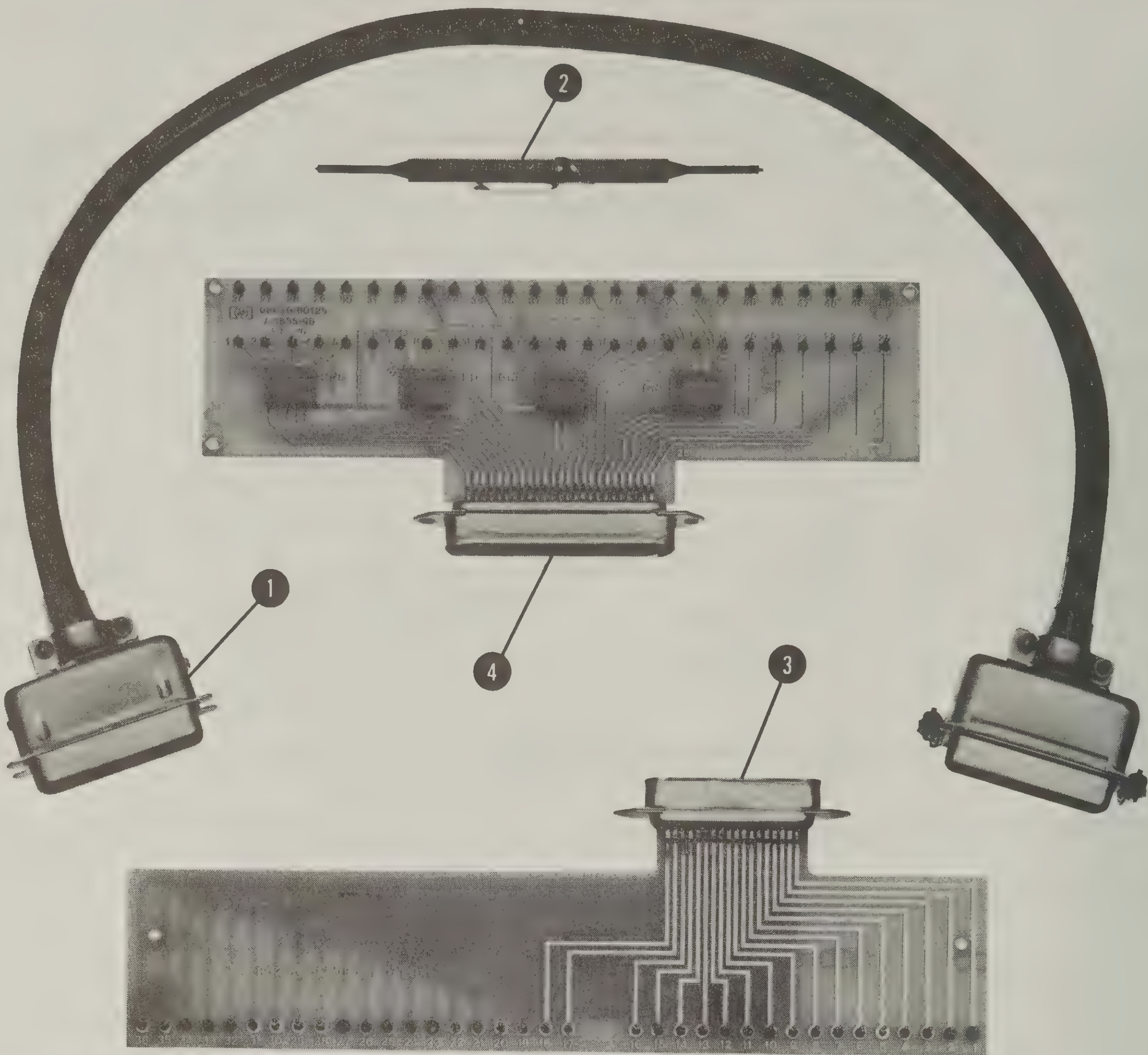
Table 1-4. Recommended Test Equipment (1 of 2)

Instrument	Critical Specification	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8620C	P,A,T
Digital Voltmeter (DVM)	Range: −50V to +50V Accuracy: ±0.01% Input Impedance: ≥10 M ohms	HP 3456A	A,T
Oscilloscope	Dual Channel Bandwidth: dc to 100 MHz Vertical Sensitivity: ≤5 mV/DIV Horizontal Sweep Rate: ≤0.1 μS/DIV External Sweep Capability	HP 1740A	P,A,T
Oscilloscope Probe	10:1 Divider Probe	HP 10004D	A
Frequency Counter	Frequency Range: 2.0 to 18.6 GHz Input Impedance: 50 ohms Resolution: ≤1 MHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 2.0 to 18.6 GHz Residual FM: <100 Hz	HP 8565A or HP 8566A	P,T
Swept Amplitude Analyzer	Capable of Transmission Measurements Power Resolution: ≤0.25 dB	HP 8755C	A
Display Mainframe	Compatible with 8755C Swept Amplitude Analyzer	HP 180T/TR, 182T/TR	A
Detector (2 required)	Compatible with Swept Amplitude Analyzer Frequency Range: 2.0 to 18.6 GHz Power Range: −20 to +10 dBm	HP 11664A	A
Adjustable AC Line Transformer	Output: 100 to 150 Vac Power: 150 Watts	General Radio MT3A	P
Adapters (2 required)	Type N (f) to Waveguide	HP P281C, Option 013	P
Adapters (2 required)	Type N (m) to APC 3.5 (f)	HP 1250-1744	A
Frequency Meter	Frequency Accuracy: ≤0.17% Calibration Increments: ≤2 MHz Frequency Range: 2.0 to 4.2 GHz 3.7 to 12.4 GHz 12.4 to 18.0 GHz 18.0 to 18.6 GHz	 HP 536A HP 537A HP P532A HP K532A	 P P P P
Function Generator	Frequency Range: 0.1 to 10 MHz sinewave and squarewave output Output Level: 10 Vp-p into 50 ohms Output Level Flatness: ≤± 3% from 10 Hz to 100 kHz ≤± 10% from 100 Hz to 10 MHz	HP 3312A	P,A,T
Power Meter	Power Range: −20 to +10 dBm (No substitute when used for external power meter leveling).	HP 432A	P,A
Thermistor Sensor and 10-dB Attenuator	Frequency Range: 2.0 to 18.6 GHz Maximum SWR: ≤1.75	HP 8478B, H32	P,A

Table 1-4. Recommended Test Equipment (2 of 2)

Instrument	Critical Specification	Recommended Model	Use*
Adapter (2 required)	Waveguide to APC 3.5 (f) (for use with HP K532)	HP K281C	A
Power Meter	Power Range: 1μW to 100 mW	HP 436A	P,A
Power Sensor	Frequency Range: 2.0 to 18.6 GHz	HP 8485A	P,A
Crystal Detector (2 required)	Frequency Response: 2.0 to 18.6 GHz Maximum Input Power: 100 mW	HP 8470B Option 012	P,A
Attenuator	Frequency Range: 2.0 to 18.6 GHz Maximum Input Power: +20 dBm Attenuation: 10 dB ±0.8 dB 3 dB ±0.5 dB	 HP 8491B Option 010 HP 8491B Option 003	 P,A P
Power Splitter	Frequency Range: 2.0 to 18.6 GHz Maximum Input Power: ≥+20 dBm	HP 11667A	P,A
Extender Cable	(See Figure 1-3.)	HP 08620-60032	P
Directional Coupler	Frequency Range: 2.0 to 18.6 GHz Nominal Coupling: ≥22 dB Maximum Coupling Variation: ±1 dB Minimum Directivity: 26 dB	HP 11691D Option 001	P
RMS Voltmeter	dB Range: 0 to −70 dBm (0 dBm = 1 mV into 600 ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A	P
Air Line Extension (2 required)	Impedance: 50 ohms Frequency Range: dc to 18 GHz Reflection Coefficient: 0.018 to 0.001 (times the frequency in GHz)	HP 11567A	P
BNC Tee (2 required)	Connectors: BNC jack and plug	HP P/N 1250-0781	
Cable	2 ft. long, BNC connectors	HP 11086A	P
Adjustable Short	Frequency Range: 1.1 to 18 GHz Impedance: 50 ±1.5 ohms	Maury Microwave 1953B	P
DC Power Supply	DC Output: 0 to 10 Vdc ±0.05 Vdc Current: 0.1 AMP	HP 6214A	A
Adjustment Tool	(See Figure 1-3.)	HP P/N 8830-60024	A
Extender Board	Reversing (See Figure 1-4.)	HP P/N 86290-60033	A
PC Board Extender	Supplied with Instrument (See Figure 1-1.)	HP P/N 86290-60020	A,T

* P = Performance Test; A = Adjustments; T = Troubleshooting



Item	Name	Part No.	Use
1	Extender Cable	08620-60032	Moves RF Plug-In outside mainframe for alignment or service.
2	Adjustment Tool	8830-0024	Fits miniature adjustment slot on potentiometers.
3	36-Pin Service Board	08620-60037	Allows probing RF Section interface connector, or rear-panel programming connector on all mainframes except 8620C, during performance testing or troubleshooting of 8620 Series mainframes.
4	50-Pin Service Board	08620-60125	Allows probing rear-panel programming connector during performance testing or troubleshooting of HP Model 8620C Sweep Oscillator mainframe.

Figure 1-3. Service Accessories, HP Part Number 08620-60124

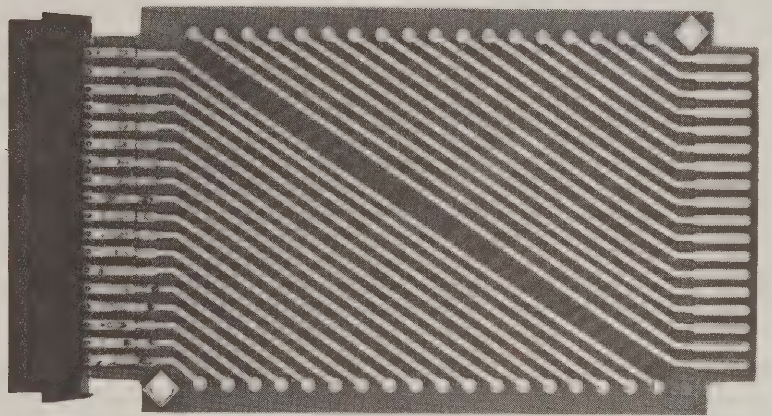
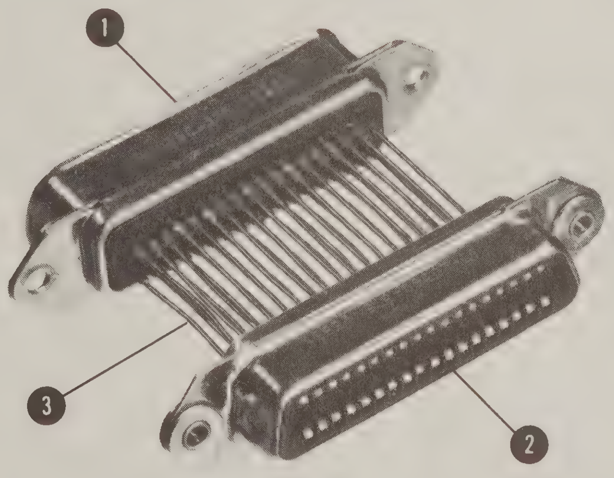


Figure 1-4. Reversing Extender Board, 86290-60033



1. 36-Pin Male Connector (2 x 18) HP Part No. 1251-0483
2. 36-Pin Female Connector (2 x 18) HP Part No. 1251-0484
3. 1-inch 20-Gage Wire HP Part No. 8151-0011

Figure 1-5. RF Section 36-Pin Extender, 08621-60056

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 86290B RF Plug-In and its accessories. This section also includes information about initial inspection and damage claims, preparation for using the RF Plug-In and packaging, storage and shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the instrument combination does not pass the electrical performance tests, refer to the 86290B Adjustments (Section V) in this manual. If after the 86290B Adjustments have been made, the instrument combination still fails to meet specifications, refer to Mainframe Adjustments in the 8620C mainframe manual. If a circuit malfunction is suspected, refer to troubleshooting information in Section VIII of this manual or 8620C mainframe manual. If the instrument does not pass the above electrical tests, or if the shipment contents are incomplete, or if there is mechanical damage or defect, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. When the Model 86290B RF Plug-In is properly installed, it obtains all power through the rear interface connection from the 8620C Sweep Oscillator mainframe.

2-8. Interconnections

2-9. For the Model 86290B RF Plug-In to operate, it must be plugged into an 8620C mainframe. Connection is made by pushing the RF Plug-In into the mainframe so that the Plug-In interface connector P1 mates with the mainframe connector.

2-10. Mating Connectors

2-11. All of the externally mounted connectors of the 86290B are listed in Table 2-1. Opposite each 86290B connector is an industry identification, the part number of a mating connector, and the part number of an alternate source for the mating connector.

2-12. Operating Environment

2-13. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

2-14. Humidity. The instrument may be operated in environments with humidity from 5% to 95% at 0° to 40°C. However, the instrument should be protected from temperature extremes which cause condensation within the instrument.

2-15. Altitude. The instrument may be operated at altitudes up to 4572 meters (15000 feet).

2-16. Frequency Scale Installation

2-17. To install frequency scale, proceed as follows:

NOTE

If mainframe has two screws on top of the front panel (See Figure 2-1), RF Plug-In does not have to be removed. Remove both screws and go to step b.

NOTE

If RF Plug-In is installed in mainframe, it must be removed to install frequency scale. See RF Plug-In removal instructions in Paragraph 2-20.

a. Disengage mainframe front-panel latch handle, shown in Figure 2-1, by pushing downward on handle while pushing inward lightly on top of front panel.

Table 2-1. Model 86290B Mating Connectors

86290B Connector		Mating Connectors	
Connector Name	Industry Identification	Part Number	Alternate Source
J1 RF OUTPUT	TYPE-N	1250-0882	Specialty Connector 25 P117-2
J2 ALC EXT INPUT	BNC	1250-0256	Specialty Connector 28 P118-1
J3 SEQ SYNC	BNC	1250-0256	Specialty Connector 28 P118-1
J4 FM	BNC	1250-0256	Specialty Connector 28 P118-1
J5 FREQ REF	BNC	1250-0256	Specialty Connector 28 P118-1
J6 AUX OUT	TYPE-N	1250-0882	Specialty Connector 25 P117-2

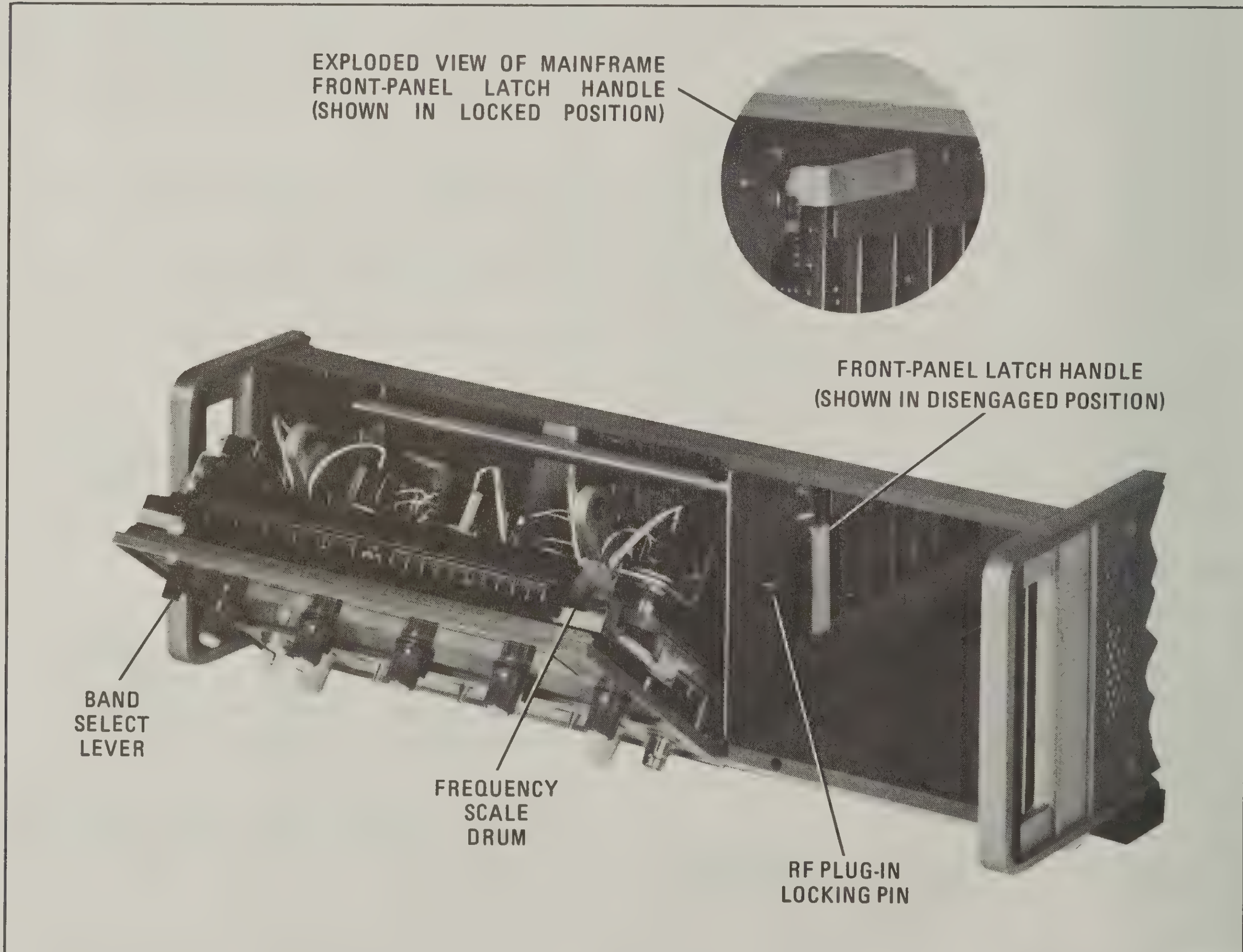


Figure 2-1. Location of Mainframe Parts Pertinent to Frequency Scale and RF Plug-In Installation

b. Swing front panel forward and down to position shown in Figure 2-2.

c. Depress mainframe front-panel BAND select lever, shown in Figure 2-1, to rotate frequency scale drum until desired scale position is accessible.

NOTE

If necessary to remove a frequency scale, exert pressure OUTWARD, away from drum on right-hand edge of scale.

d. Insert frequency scale so key (a 1/16-inch long, 1/2-inch wide protrusion) on left end of scale fits into notch, shown in Figure 2-2, in roller on left-hand edge of drum.

e. Push inward on right-hand edge of frequency scale to snap it in place in frequency scale drum.

CAUTION

To prevent damage to frequency pointers when bandswitch drum is rotated, make certain that frequency scale is firmly in place and flush with band drum edges.

f. Return front panel to upright (closed) position. If front panel was secured with two screws (see Figure 2-1), replace screws. If not, while pushing inward lightly on top of front panel, re-engage front-panel latch handle by pushing it upward to lock position as shown in Figure 2-1, exploded view.

2-18. RF Plug-In Installation and Removal

2-19. Installation. To install RF Plug-In, proceed as follows:

a. If mainframe power is ON, press mainframe LINE switch to OFF position.

b. Position latch handle located on left side of RF Plug-In so it is perpendicular to front panel. Portion of handle with rectangular cut-out should be facing forward and portion with notch should be facing rear of RF Plug-In as shown in Figure 2-3.

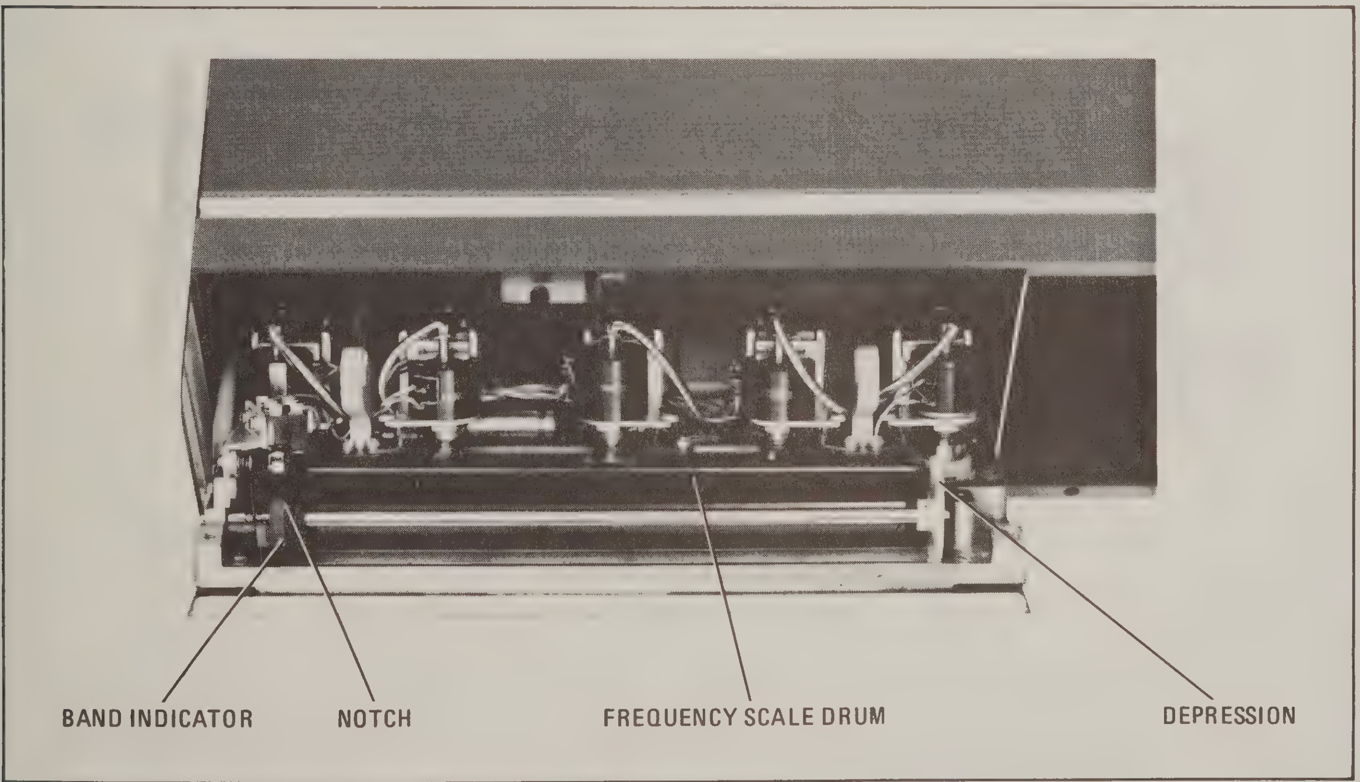


Figure 2-2. Mainframe Front Panel in Open Position

c. Slide RF Plug-In into mainframe towards rear of compartment. RF Plug-In latch handle will engage a locking pin, shown in Figure 2-1, inside mainframe and exposed portion of latch handle will start to move downward.

d. Push latch handle downward, while still pushing inward on RF Plug-In, until latch handle is flush with front panel.

2-20. Removal. To remove RF Plug-In, proceed as follows:

a. Push inward on top of latch handle, shown in Figure 2-3, and pull forward and up on bottom of latch handle.

b. When exposed portion of latch handle is in a position perpendicualar to RF Plug-In front panel, it is disengaged from locking pin (Figure 2-1) and RF Plug-In may be removed by pulling forward on latch handle.

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument may be stored or shipped in environments within the following limits:

Temperature	−40°C to +75°C
Humidity	5% to 95% at 0° to 40°C
Altitude	Up to 15240 meters (50000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-24. Packaging

2-25. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number and full serial

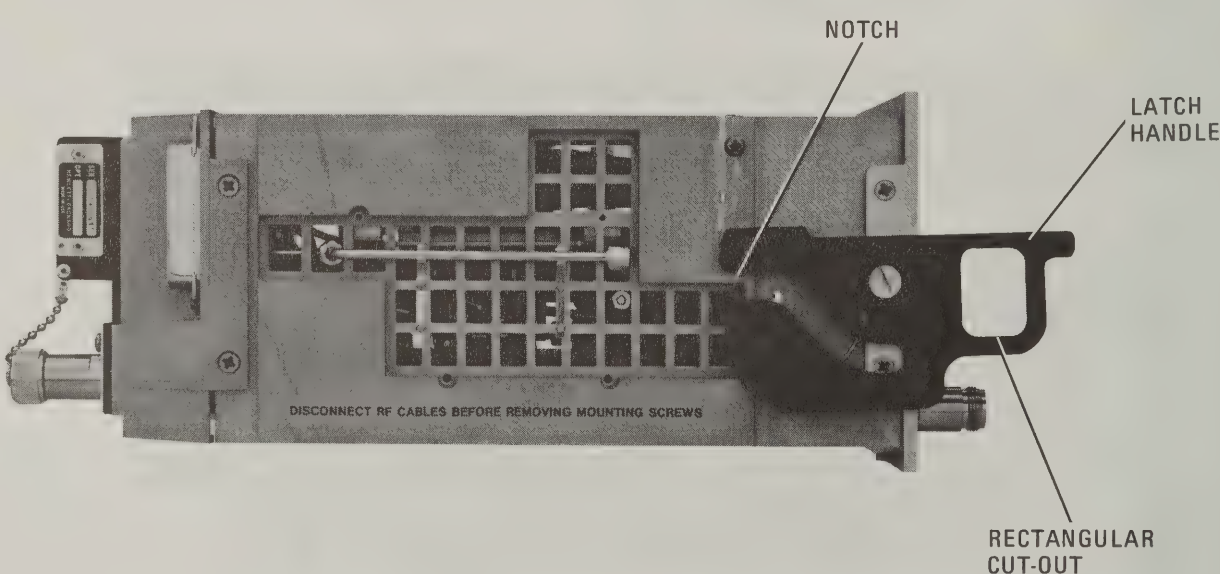


Figure 2-3. RF Plug-In Latch in Release Position

number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-26. Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

a. Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard Office or Service Center, attach tag indicating type of service required, return address, model number and full serial number.)

b. Use a strong shipping container.

c. Use enough shock-absorbing material around all sides of instrument to provide firm cushion and prevent movement inside container. Protect control panel with cardboard.

d. Seal shipping container securely.

e. Mark shipping container FRAGILE to ensure careful handling.

f. In any correspondence, refer to instrument by model number and full serial number.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This operating section explains the function of the controls and indicators of the Model 86290B RF Plug-In. It describes typical operating modes in a measurement system and covers operator replacement of indicator lamps. Figure 3-14 shows the positions of the ALC Function switch A1S1 that the operator sets for each application.

3-3. PANEL FEATURES

3-4. Front and rear panel features are described in Figures 3-2 through 3-5. Description numbers match the numbers on the illustration.

3-5. OPERATOR'S CHECKS

3-6. The Operator's Checks (Figure 3-6) allow the operator to make quick evaluation of the instrument's main functions prior to use. These checks assume that the 86290B Plug-In is installed in an 8620C Sweep Oscillator mainframe. The checks cover the RF Plug-In and mainframe; therefore, if the correct indications are not obtained, trouble may be in either of the units. If the RF Plug-In is suspected, perform applicable performance tests in Section IV of this manual, and if necessary, the related adjustments in Section V. If correct indications are still not obtained, refer to the troubleshooting information in Section VIII to isolate the problem.

3-7. OPERATING INSTRUCTIONS

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protecting earth terminal could make this instrument dangerous.

NOTE

Instrument may not meet maximum leveled power specifications when UNLEVELED lamp is lit.

NOTE

To use the Plug-In in the remote programming mode, a modification to the 8620C should be performed as shown in Service Sheet 5 (Remote Programming).

3-8. Internal Leveling

3-9. The most convenient method of RF output leveling is internal leveling. A portion of the RF output is coupled from a directional Coupler DC1 to a Detector CR1. A proportional dc-voltage is applied to an operational amplifier in the 86290B ALC Amplifier Assembly A1. The Operator's Checks in Figure 3-6 are performed in the internal leveling mode.

3-10. External Power Meter Leveling

3-11. Power leveling can be obtained with a power meter and power splitter or directional coupler as shown in Figure 3-10. A sample of the RF output signal is routed to a power meter to produce a dc voltage proportional to the RF signal level. The dc voltage is applied to the 86290B ALC circuits and compared with an internal reference voltage. A difference voltage is produced and amplified by the ALC amplifier before being applied, as modulator drive, to the Coupler/Modulator assembly A10. The modulator drive controls the output of the Coupler/Modulator to maintain a constant power level.

3-12. External Crystal Detector Leveling

3-13. Power may be leveled externally using a power splitter (or directional coupler) and crystal detector. This leveling system uses a power splitter to sample the RF output signal and a crystal detector to produce a dc voltage proportional to RF signal level. The detector voltage is compared with an internal reference voltage, and the difference voltage changes the output power level to keep it constant at the output. Instead of a power splitter, a directional coupler may be used to sample the RF signal for the leveling loop. Directional couplers are usually narrow band, whereas the power splitter is flat over a wide frequency range. The advantage of the directional coupler is that it does not have a 6-dB loss like the power splitter; therefore, a higher maximum leveled power output may be obtained. To place the crystal detector leveling loop in operation, use the test setup and procedures in Figure 3-13.

3-14. Internal AM

3-15. The 8620C Sweep Oscillator mainframe has an internal 1 kHz square wave for internal amplitude modulation of the RF signal. This provides an ON/OFF ratio of <25 dB for all bands of the 86290B.

3-16. External AM

3-17. The 86290B RF Output (CW) signal can be amplitude modulated from 0 to 100% using an external modulating signal applied to the mainframe EXT AM connector. This provides an ON/OFF ratio of >30 dB for all bands of the 86290B. A positive 5 volts input reduces the RF power output to at least 30 dB below specified maximum power.

3-18. External FM

3-19. The 86290B RF Output signal can be frequency modulated using an external modulating signal applied to the 86290B FM Input connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an external modulation signal. A positive-going voltage causes output frequency to decrease while a negative-going voltage causes output frequency to increase.

3-20. Frequency Reference

3-21. A sweep signal output is available at the rear-panel FREQ REF connector J5 for phase-locking external equipment. The sweep signal is approximately +1V/GHz.

3-22. Phase-Lock Operation

3-23. The 86290B RF Output (CW) signal may be phase-locked using an external phase-lock signal applied to the 86290B FM Input connector. The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the source. If the CW frequency starts to drift, the phase difference between the CW frequency and the reference frequency (reference oscillator) is detected, producing a dc voltage. The dc voltage is a correction signal which restores the CW frequency to its previous point. Stability of this CW frequency is determined by the stability of the reference oscillator.

3-24. X-Y Recorder Operation

3-25. In Sequential Sweep operation (Band 4), the power output of the 86290B goes to zero at each switch-point for a brief time interval. This is approximately 6 ms between Bands 1 and 2 and approximately 8 ms between Bands 2 and 3. (See Section VIII for a complete explanation of Sequential Sweep operation.)

3-26. When an X-Y Recorder is used to plot the detected RF amplitude from the 86290B, the recorder's frequency response is not adequate to respond fully to this "zero-power" interval and will indicate a small negative going spike only. The width of this spike is a function of sweep speed, and is essentially zero for sweep times greater than 20 seconds.

3-27. Recorders without DELAY MUTE capability will display the "zero-power" spikes at each switch-point and is unavoidable. However, information loss caused by the spikes can be eliminated by using a slow enough sweep time (<20 sec). Recorders with DELAY MUTE capability can be operated so that "zero-power" spikes are eliminated. This is accomplished by connecting the 86290B SEQ SYN rear-panel output to the X-Y Recorder DELAY MUTE input. Using this DELAY MUTE feature will give a "glitch" free plot for test devices that have relatively flat responses at the switch point frequencies. However, test devices having a rapid rate of change across a switch-point, such as the Band Pass filter illustrated in Figure 3-1, may still show a slight "glitch." Since it may not be immediately apparent that the "glitch" is caused by the test setup rather than the device under test, it is recommended that a reference plot be made using the X-Y Recorder PEN LIFT input whenever "glitches" appear in the test device output near the 6.2 GHz and 12.4 GHz switch-point frequencies. The PEN LIFT Input will not affect the switch-points; therefore, the source of the "glitch" can be easily recognized. This is illustrated in Figure 3-1.

3-28. Retrace time of the 8620C mainframe, when using an 86290B is much faster than sweep time. When RF Blanking is used, 86290B power output goes to "zero-power" as rapidly as the 86290B. Therefore, the retrace line on the X-Y recorder will not resemble actual RF response. This can be improved by placing the mainframe rear-panel RF BLANKING/OFF switch in the OFF position. If "zero-power" reference line is desired, one may be drawn by triggering a single sweep with 86290B power off (front-panel RF ON-OFF switch OFF.)

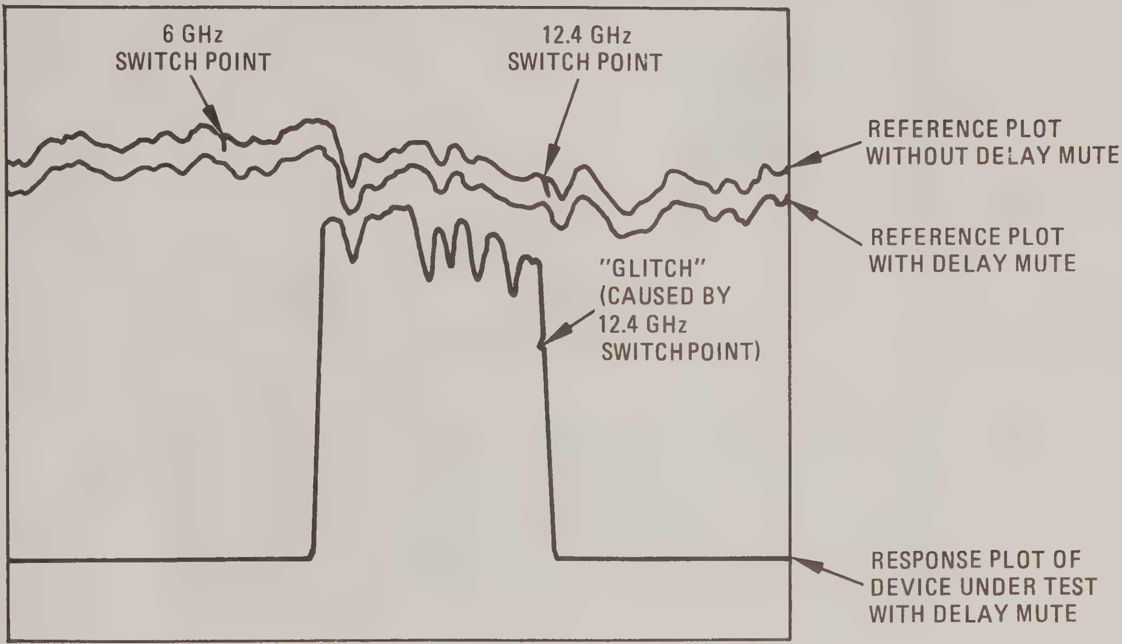


Figure 3-1. Typical Recorder Plot of Device Under Test and Reference Plots

3-29. X-Y RECORDER MODIFICATION KIT

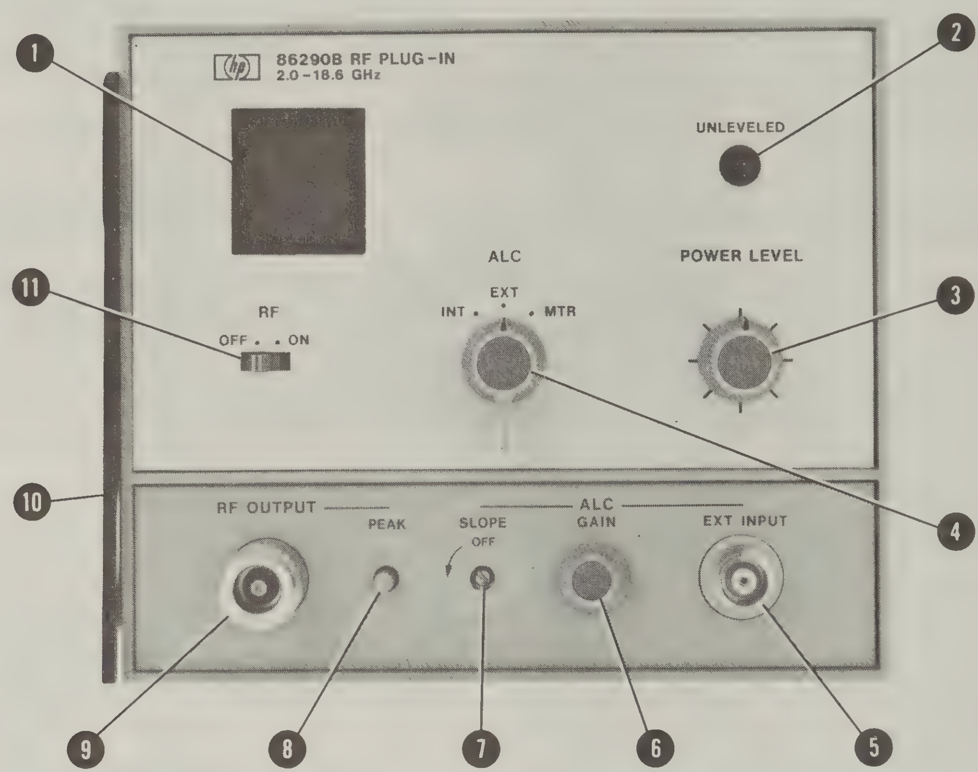
3-30. A modification kit is available to convert older X-Y Recorders to obtain DELAY MUTE capability. See the X-Y Recorder Operating and Service Manual or contact your nearest Hewlett-Packard Office for part number information. Addresses of HP Offices are provided at the rear of this manual.

3-31. OPERATOR'S MAINTENANCE

3-32. Operator maintenance on the 86290B consists of replacing defective front panel Band indicator lamps. Removal and replacement procedures are contained in Figure 3-15.

3-33. Replacement of the UNLEVELED lamp is shown in Section VIII as a maintenance procedure. (See Figure 8-2.)

FRONT PANEL FEATURES



1 **Frequency/Band Display Indicators A8DS1 – A8DS4:**

2.0 – 6.2 GHz.	Illuminates with Band 1 selected on mainframe.
6.0 – 12.4 GHz.	Illuminates with Band 2 selected on mainframe.
12.0 – 18.6 GHz.	Illuminates with Band 3 selected on mainframe.
2.0 – 18.6 GHz.	Illuminates with Band 4 selected on mainframe. Band 4 is the Sequential Sweep.

2 **UNLEVELED lamp DS1.** Lights if output power is unleveled across selected frequency range.

3 **POWER LEVEL control R1.** Adjusts RF output power. Clockwise rotatation increases output power.

4 **ALC switch S2.** Selects INT (internal), EXT (external), or MTR (power meter) power leveling modes.

Figure 3-2. Front Panel Controls, Connectors and Indicators (1 of 2)

FRONT PANEL FEATURES

5 **ALC EXT INPUT BNC connector J2.** Input for external leveling from power meter or crystal detector.

6 **ALC GAIN control R4.** Adjusts ALC leveling amplifier gain when system is using an external leveling loop. Clockwise rotation increases ALC loop gain.

7 **ALC SLOPE-OFF control R3.** Compensates for high frequency power losses in external RF cables by attenuating power at lower frequencies. This compensation provides a flat RF signal output. The OFF Position removes all compensation.

8 **RF OUTPUT PEAK control R2.** Optimizes RF output power for selected frequency range and assures minimum harmonically related signals.

9 **RF OUTPUT connector J1.** Type-N 50-ohm RF output connector (APC-7 for Option 005).

CAUTION

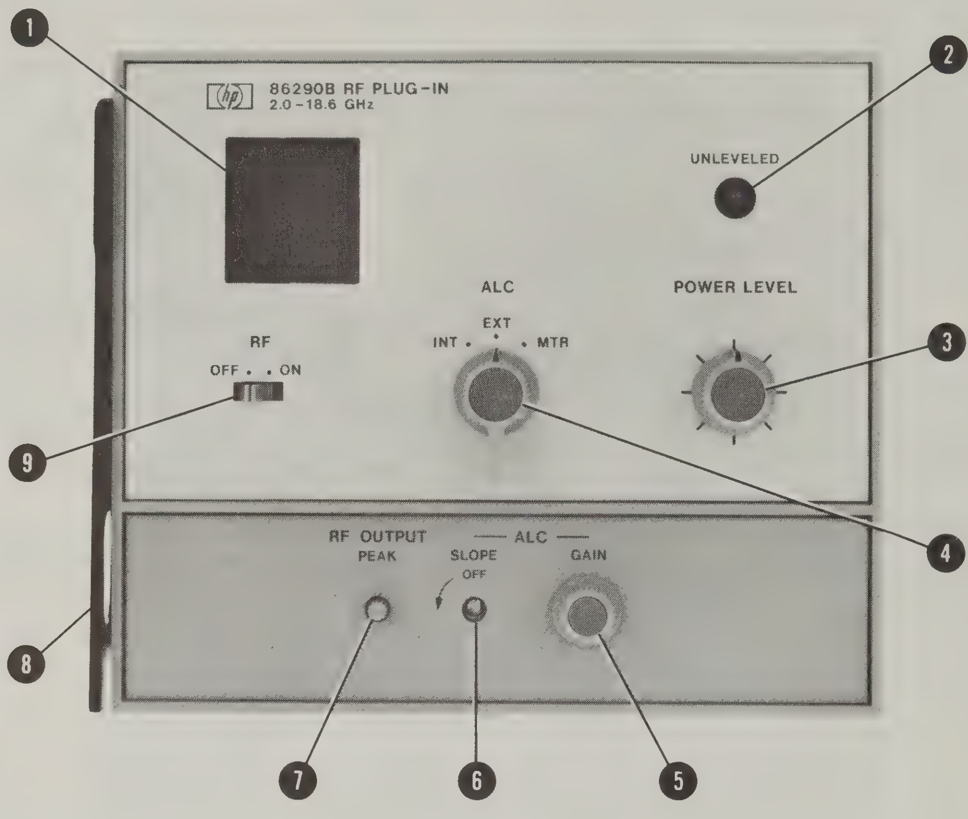
Do not apply any DC voltage to the RF OUTPUT connector or damage to the instrument may occur.

10 **Drawer Latching Handle.** Aids in installing and removing RF Plug-In. After installation, handle locks to hold RF Plug-In in place.

11 **RF ON-OFF switch S1.** Turns RF power on and off. This is useful when zeroing a power meter or establishing a zero power reference on an X-Y recorder.

Figure 3-2. Front Panel Controls, Connectors and Indicators (2 of 2)

FRONT PANEL FEATURES OPTION 004



1 **Frequency/Band Display indicators A8DS1 – A8DS4:**

2.0 – 6.2 GHz.	Illuminates with Band 1 selected on mainframe.
6.0 – 12.4 GHz.	Illuminates with Band 2 selected on mainframe.
12.0 – 18.6 GHz.	Illuminates with Band 3 selected on mainframe.
2.0 – 18.6 GHz.	Illuminates with Band 4 selected on mainframe. Band 4 is the Sequential Sweep.

2 **UNLEVELED Lamp DS1.** Lights if output power is unleveled across selected frequency range or if automatic leveling is not used.

3 **POWER LEVEL control R1.** Adjusts RF output power. Clockwise rotation increases output power.

4 **ACL switch S2.** Selects INT (internal), EXT (external), or MTR (power meter) power leveling modes.

5 **ALC GAIN control R4.** Adjusts ALC leveling amplifier gain when system is using an external leveling loop. Clockwise rotation increases ALC loop gain.

6 **ALC SLOPE-OFF control R3.** Compensates for high frequency power losses in external RF cables by attenuating power at lower frequencies. This compensation provides a leveled RF signal out. The OFF position removes all compensation.

7 **RF OUTPUT PEAK control R2.** Optimizes RF output power for selected frequency range and assures minimum harmonically related signals.

Figure 3-3. Front Panel Controls, Connectors and Indicators (1 of 2), Option 004

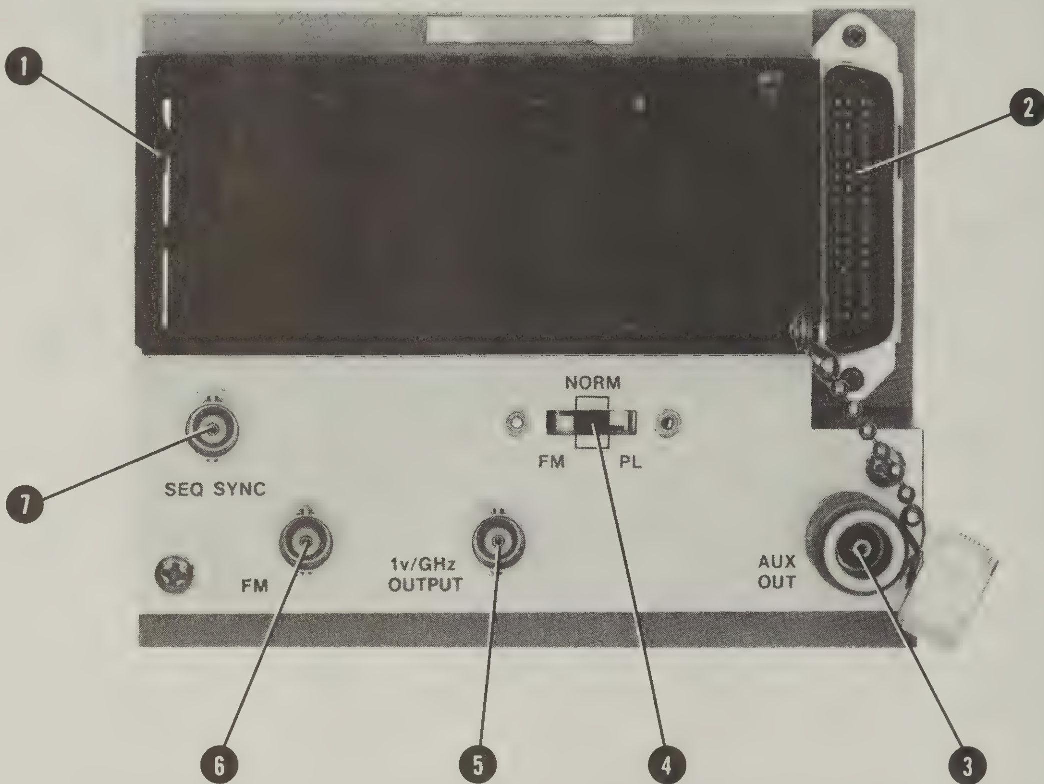
FRONT PANEL FEATURES
OPTION 004

8 **Drawer Latching Handle.** Aids in installing and removing RF Plug-In. After installing, handle locks to hold RF Plug-In in place.

9 **RF ON-OFF switch S1.** Turns RF power on and off. This is useful when zeroing a power meter or establishing a zero power reference on an X-Y recorder.

Figure 3-3. Front Panel Controls, Connectors and Indicators (2 of 2), Option 004

REAR PANEL FEATURES



1. **Rear panel Heatsink.** Provides heat dissipation and mounting for YTM and YTO coil-driver transistors Ql and Q2, and reference resistors R5 and R6.

2. **Interface Connector P1.** Provides interconnection between 8620C mainframe and 86290B RF Plug-In.

3. **AUX OUT J6.** Provides YIG-tuned Oscillator RF output signal of 2.0 – 6.2 GHz. (Cover provided should be installed when AUX OUT not used.)

4. **FM-NORM-PL switch S3.** Operates in conjunction with FM input connector to provide optimum performance for either normal sweep (NORM), frequency modulation (FM), or phase-lock (PL) operation. If FM or PL modes of operation are not being used, switch should be in NORM.

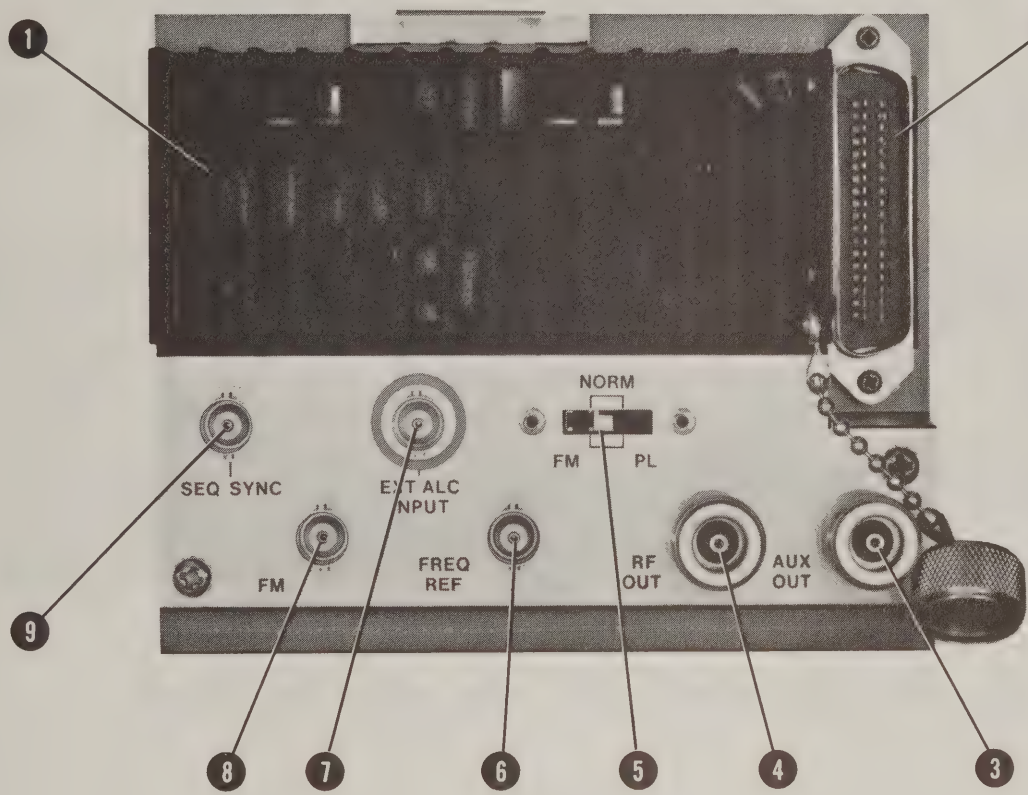
5. **FREQ REF BNC connector J5.** Provides approximately +1 volt/GHz ramp signal output.

6. **FM BNC connector J4.** Input connector for FM modulation signal or phase locking error signal.

7. **SEQ SYNC connector J3.** Provides RF blanking output for timing signal to external equipment.

Figure 3-4. Rear Panel Connectors and Switch

REAR PANEL FEATURES
OPTION 004



1. **Rear Panel Heatsink.** Provides heat dissipation and mounting for YTM and YTO coil-driver transistors Q1 and Q2, and reference resistors R5 and R6.

2. **Interface Connector P1.** Provides interconnnection between 8620C mainframe and 86290B RF Plug-In.

3. **AUX OUT J6.** Provides YIG-tuned Oscillator RF output signal of 2.0 – 6.2 GHz.

4. **RF OUT connector J9.** Type-N 50-ohm RF output connector. (APC-7 for Option 005.)

CAUTION

Do not apply any DC voltage to the RF OUTPUT connector or damage to the instrument may occur.

5. **FM-NORM-PL switch S3.** Operates in conjunction with FM input connector to provide optimum performance for either normal sweep (NORM), frequency modulation (FM), or phase lock (PL) operation. If FM or PL modes of operation are not being used, switch should be in NORM.

6. **FREQ REF BNC connector J5.** Provides approximately +1 volt/GHz ramp signal output.

7. **EXT ALC INPUT BNC connector J10.** Input for external leveling from power meter or crystal detector.

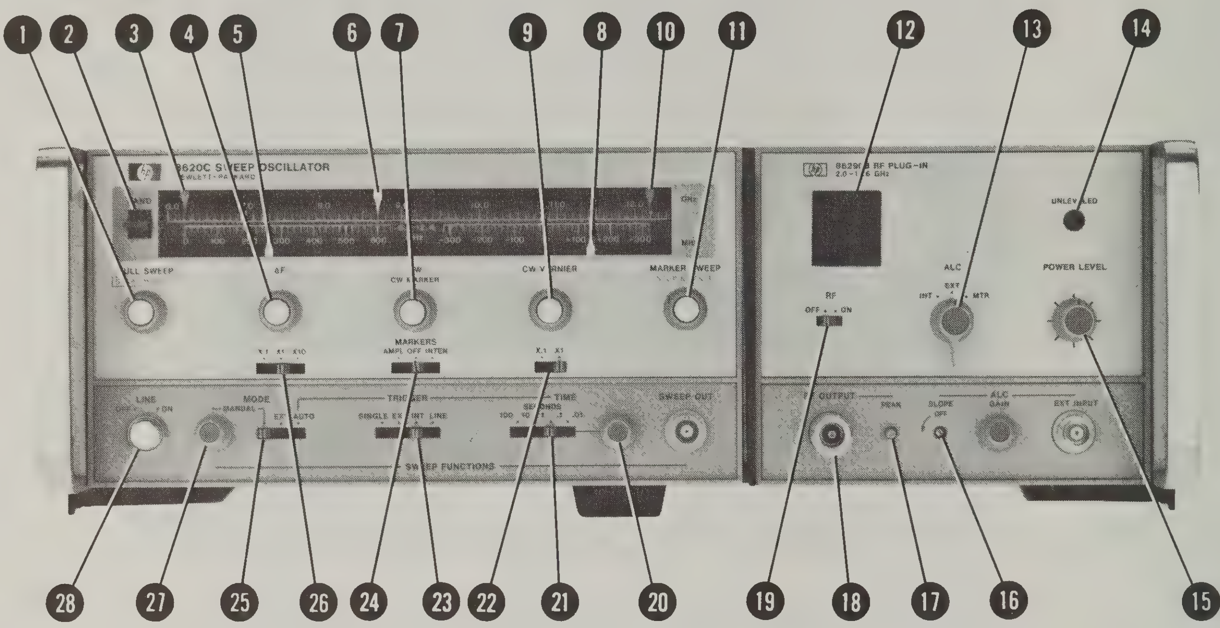
8. **FM BNC connector J4.** Input connector for FM modulation signal or phase locking error signal.

9. **SEQ SYNC connector J3.** Provides RF blanking output for timing signal to external equipment.

Figure 3-5. Rear Panel Connectors and Switch, Option 004

OPERATOR'S CHECKS

FRONT



REAR

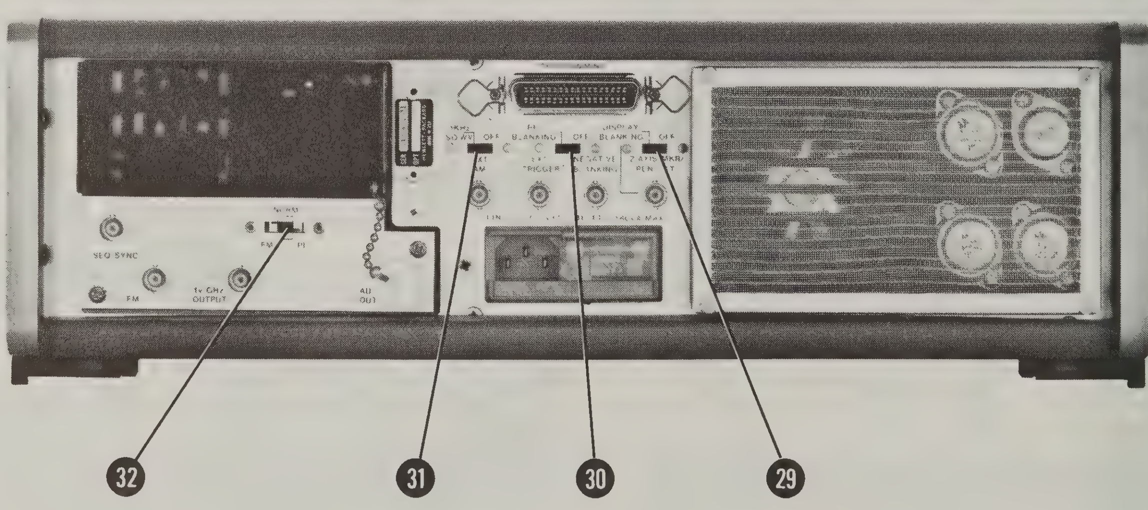
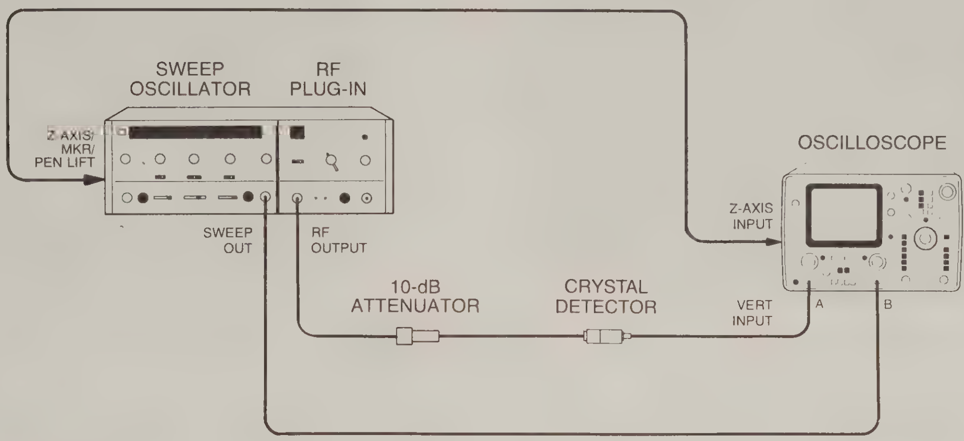


Figure 3-6. Operator's Checks (1 of 3)

OPERATOR'S CHECKS



EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
Crystal Detector	HP 8470B, Option 012
10-dB Attenuator	HP 8491B, Option 010

CAUTION

Do not apply any DC voltage to the RF OUTPUT connector or damage to the instrument may occur.

NOTE

All procedures are written using the 8620C Sweep Oscillator. The 86290B will not operate with an 8620A or 8620B mainframe.

PROCEDURE:

1. Connect equipment as shown in test setup.

2. Set controls as follows:

8620C:

BAND 2	BAND 4
MARKERS 24	INTEN
MODE 25	INT
TIME-SECONDS 21	.1 – .01
TIME-SECONDS Vernier 20	Clockwise
1 kHz SQ WV/OFF (rear panel) 31	OFF
DISPLAY BLANKING/OFF (rear panel) 29	DISPLAY BLANKING
RF BLANKING/OFF (rear panel) 30	OFF

Figure 3-6. Operator's Checks (2 of 3)

OPERATOR'S CHECKS

86290B:

RF OUTPUT 18 19	ON
POWER LEVEL 15	Fully clockwise
ALC 13	INT
SLOPE-OFF 16	OFF
FM-NORM-PL (rear panel) 32	NORM (Normal)

3. Press LINE pushbutton switch 28 to ON, LINE 28, and FULL SWEEP 1 pushbuttons should light. The 2.0 – 18.6 GHz lamp 12 should light on 86290B.

4. Check that the instrument is sweeping correctly. This is indicated by a continuous signal-level line below zero-volt dc level on oscilloscope. Adjust PEAK control 17 for maximum signal on oscilloscope.

5. UNLEVELED lamp 14 may be lit. If UNLEVELED lamp is lit, reduce output power by turning 86290B POWER LEVEL control 15 counterclockwise until UNLEVELED lamp goes out. This is adjustment point for maximum leveled power. Oscilloscope trace should be leveled. (Refer to Figures 3-7 and 3-8 for typical oscilloscope display of Sequential Sweep unleveled and leveled RF Power Output. Refer to Figures 3-9 and 3-10 for single-band displays.)

6. Set 8620C MARKERS switch 24 to INTEN position. Markers should appear on oscilloscope trace as bright dots. Adjust oscilloscope intensity for best contrast. Set MARKERS switch to AMPL position. Markers should appear on oscilloscope trace as pips.

7. Set 8620C MODE switch 25 to MANUAL position and slowly adjust MANUAL control. 27 Trace dot should move across oscilloscope. Return 8620C MODE switch to AUTO.

8. Press 8620C CW pushbutton 7; pushbutton should light and trace on oscilloscope should be a dot. Change frequency 7 with CW Marker control. Dot should move across oscilloscope.

9. Press 8620C CW VERNIER pushbutton switch 9; pushbutton should light. Adjust CW VERNIER control. White pointer 8 above CW VERNIER control should move. Dot on oscilloscope should also move across CRT at a very slow rate and through a narrow range. CW VERNIER slide switch 22 selects a 0.1 multiplier (X.1 position) for CW vernier scale; in X1 position, scale is read directly. Press 8620C CW pushbutton; CW VERNIER pushbutton lamp should turn off.

10. Press 8620C ΔF pushbutton 4; ΔF and CW 7 pushbuttons should be lit. Deviation from CW frequency is selected by ΔF control, and adjusting it moves white pointer 5 above ΔF control. ΔF slide switch 26 selects a 0.1 multiplier (X.1 position), or a 10 multiplier (X10 position).

11. Adjust POWER LEVEL control 15 fully clockwise. Adjust 8620C ΔF control 4 between zero and maximum. Sweep trace should be displayed on oscilloscope and should change as ΔF control is adjusted.

Figure 3-6. Operator's Checks (3 of 3)

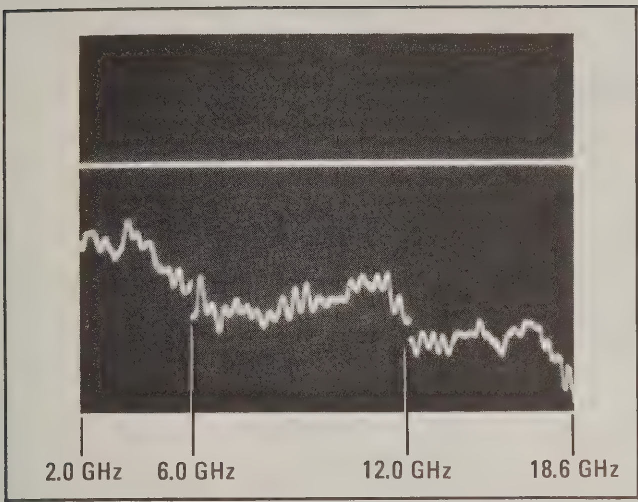


Figure 3-7. Unleveled RF Power Output for Sequential Sweep

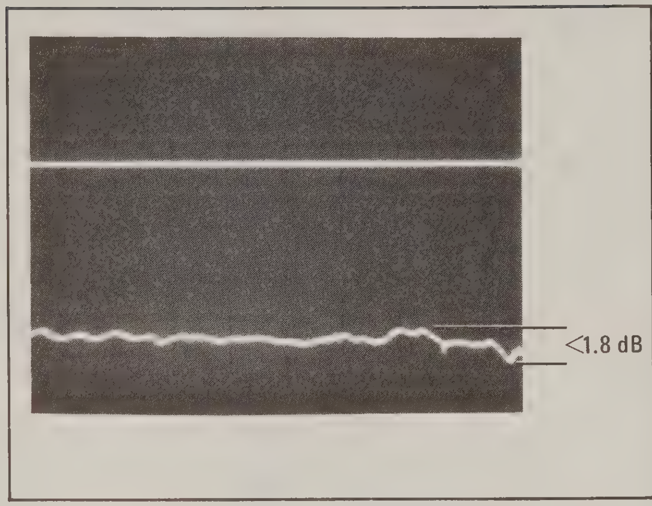


Figure 3-8. Leveled RF Power Output for Sequential Sweep

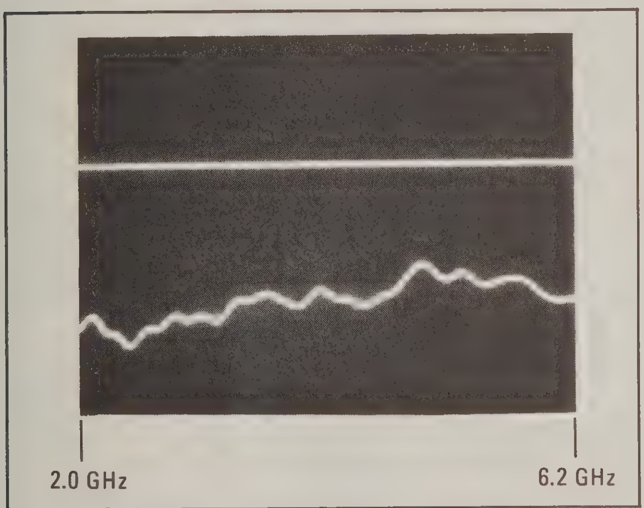


Figure 3-9. Unleveled RF Power Output for Single Band (Band 1)

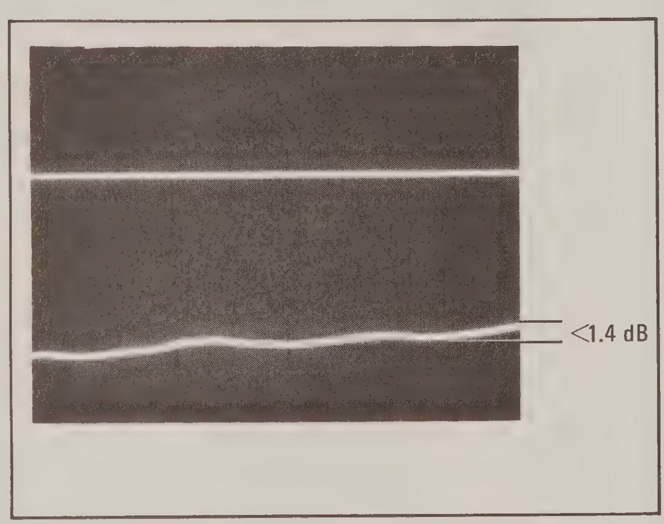


Figure 3-10. Leveled RF Power Output for Single Band (Band 1)

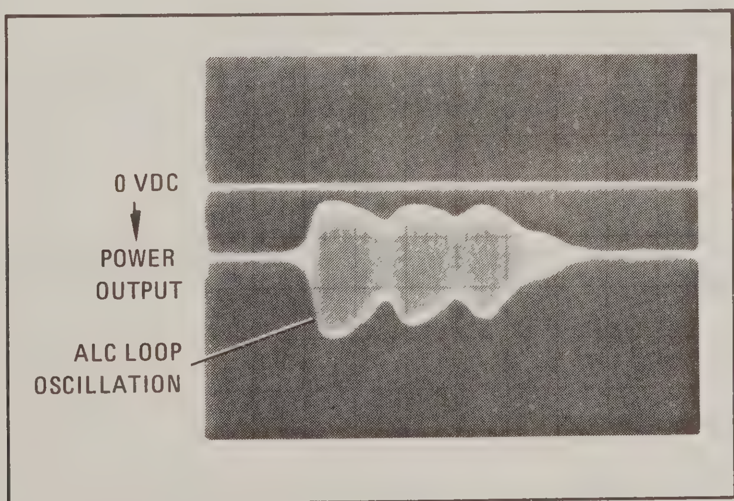
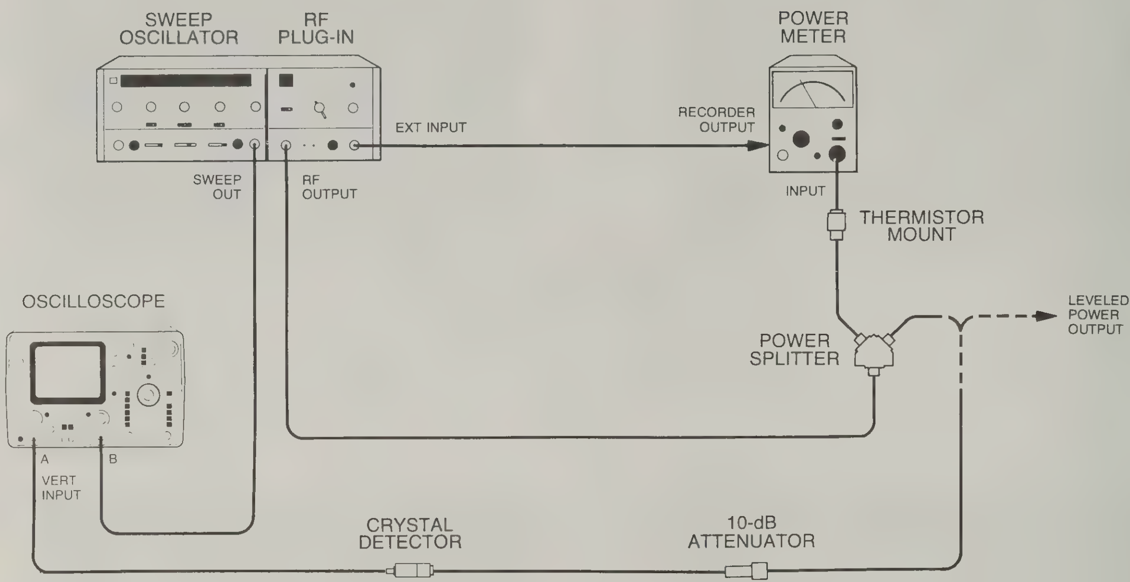


Figure 3-11. Oscillations Due to Excessive ALC Loop Gain

EXTERNAL POWER METER LEVELING



EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
Power Meter	HP 432A
Thermistor Sensor	HP 8478B
Crystal Detector	HP 8470B, Option 012
10-dB Attenuator	HP 8491B, Option 010
Power Splitter	HP 11667A

CAUTION

Do not apply any DC voltage to the RF OUTPUT connector or damage to the instrument may occur.

NOTE

Power meter leveling should be used at slowest sweep rates. Leveling is limited by response time of thermistor sensor.

PROCEDURE:

1. Connect equipment as shown in test setup.

Figure 3-12. External Power Meter Leveling (1 of 2)

EXTERNAL POWER METER LEVELING

2. Set controls as follows:

8620C:

BAND	BAND 4
MARKERS	OFF
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	100-10
TIME-SECONDS Vernier	Fully clockwise
1 kHz SQ WAVE-OFF (rear panel)	OFF
DISPLAY BLANKING/OFF (rear panel)	DISPLAY BLANKING

86290B:

RF OUTPUT	ON
POWER LEVEL	Fully clockwise
ALC	MTR (Power Meter)
ALC-GAIN	Fully counterclockwise
FM-NORM-PL (rear panel)	NORM (Normal)

3. Press 8620C LINE pushbutton to ON; LINE and FULL SWEEP pushbuttons should light, indicating FULL SWEEP sweep mode is selected. The 2.0 – 18.6 GHz lamp should light on 86290B.

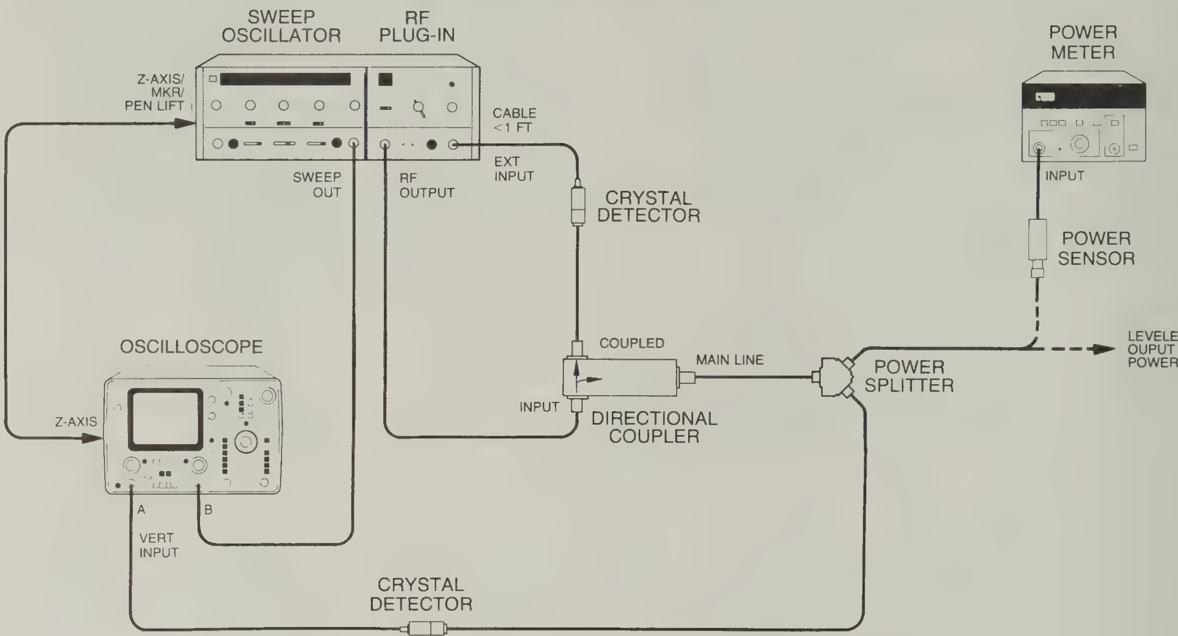
4. Select range on power meter to obtain indication near top 1/3 of meter scale.

5. Adjust 86290B ALC GAIN control clockwise until leveling across band occurs as shown in Figure 3-8. If trace is not leveled or is only partially leveled (as shown in Figure 3-7) with ALC GAIN fully clockwise, reduce RF OUTPUT power. This is done by adjusting POWER LEVEL control counterclockwise until leveling occurs as shown in Figure 3-8. If oscillations appear on trace as shown in Figure 3-11, turn ALC GAIN control counterclockwise. With proper leveling across the band, the 86290B UNLEVELED light should be out.

6. To use leveled RF Power output for testing external equipment, make connection at point marked “Leveled Power Output.”

Figure 3-12. External Power Meter Leveling (2 of 2)

EXTERNAL CRYSTAL DETECTOR LEVELING



NOTE

Cables in the ALC loop must be kept <1 foot in length for best response.

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
Power Meter	HP 436A
Crystal Detector (2 required)	HP 8470B, Option 012
Power Splitter	HP 11667A
Directional Coupler	HP 11691D, Option CO-2
Power Sensor	8485A

PROCEDURE:

1. Connect equipment as shown in test setup.

CAUTION

Do not apply any DC voltage to the RF OUTPUT connector or damage to the instrument may occur.

NOTE

Crystal Detector output should be between 50 mVdc and 750 mVdc.

Figure 3-13. External Crystal Detector Leveling (1 of 2)

EXTERNAL CRYSTAL DETECTOR LEVELING

2. Set controls as follows:

   8620C:

BAND	BAND 4, 2.0 – 18.6 GHz
MARKER	OFF
MODE	AUTO
TRIGGER	INT
TIME/SECONDS Vernier	Fully clockwise
1 kHz SQ WAVE/OFF (rear panel)	DISPLAY BLANKING

   86290B:

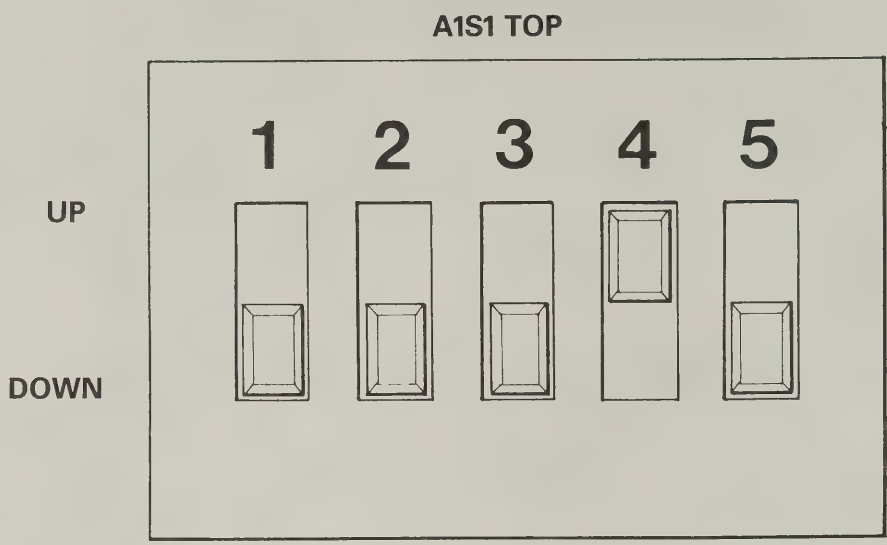
RF OUTPUT	ON
POWER LEVEL	Fully clockwise
ALC	EXT
ALC GAIN	Fully clockwise
FM-NORM-PL (rear panel)	NORM (Normal)

3. Press 8620C LINE pushbutton to ON; LINE and FULL SWEEP pushbuttons should light, indicating FULL SWEEP sweep mode is selected. The 2.0 – 18.6 GHz lamp should light on 86290B.

4. Adjust ALC GAIN and POWER LEVEL controls fully clockwise for maximum RF power OUTPUT and maximum ALC Loop gain. Adjust PEAK control for maximum RF power. One of the conditions shown in Figures 3-7 through 3-11 should be displayed on oscilloscope. If trace is unleveled as shown in Figure 3-7 or 3-9 (or partially leveled) and UNLEVELED lamp is on, turn POWER LEVEL control counterclockwise until trace is level (see Figures 3-8 and 3-10). If ALC loop gain is too high, oscillations may occur as shown in Figure 3-11. To remove oscillations, reduce ALC loop gain by turning ALC GAIN control counterclockwise.

5. To use leveled RF power output for testing external equipment, make connection at point marked "Leveled Power Output."

Figure 3-13. External Crystal Detector Leveling (2 of 2)



POSITIONS[1]	FUNCTIONS
1 and 2	Spares
3 UP	Upper Clamp Removed
DOWN	Upper Clamp In (INT operation only)[2]
4 UP	Square Wave Modulation ON[3]
DOWN	No Modulation
5 UP	Sine Wave Modulation ON[4]
DOWN	No Modulation

NOTE

Only one Modulation Mode should be UP (ON) at a time.

[1]On some switches, the UP position is marked ON; on others, the DOWN position is marked with a dot.

[2]In INTernal mode and when position 3 is DOWN, the 86290B output power is clamped typically at +13 dBm by the Upper Power Clamp on the A1 ALC Assembly.

[3]Non-linear modulation mode.

[4]Linear modulation mode.

Figure 3-14. Switch Positions and Functions for ALC Function Switch A1S1

BAND INDICATOR LAMP REPLACEMENT

1. Press mainframe LINE switch to OFF position.

2. Remove 86290B RF Plug-In from mainframe.

3. Remove front panel:

NOTE

If instrument has Option 004 (rear-panel RF OUT) installed, proceed to step b.

   a. Disconnect cable W10 from RF OUTPUT connector J1.

   b. Remove Drawer Latch Handle 5 by removing screw 3 and latch spring 2. Note position of spring 2 and location of hole 1 for reinstalling.

   c. Remove four screws 4 from front panel (two on each side).

   d. Pull front panel out of frame slightly and remove connector J7 from A7 Master Board.

4. Remove and replace lamp:

   a. Lift contact spring 6 slightly and rotate it to expose base of lamp (A8DS1-A8DS4). Remove old lamp.

NOTE

Lifting the contact spring too far may bend it, reducing spring tension.

   b. Install new lamp and replace contact spring 6 over base.

5. Install front panel by reversing instructions in Step 3.

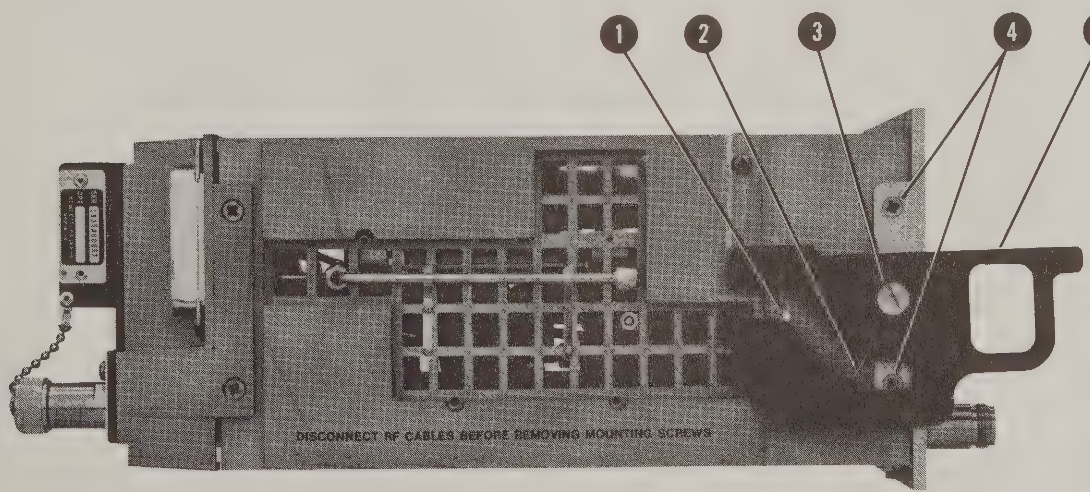
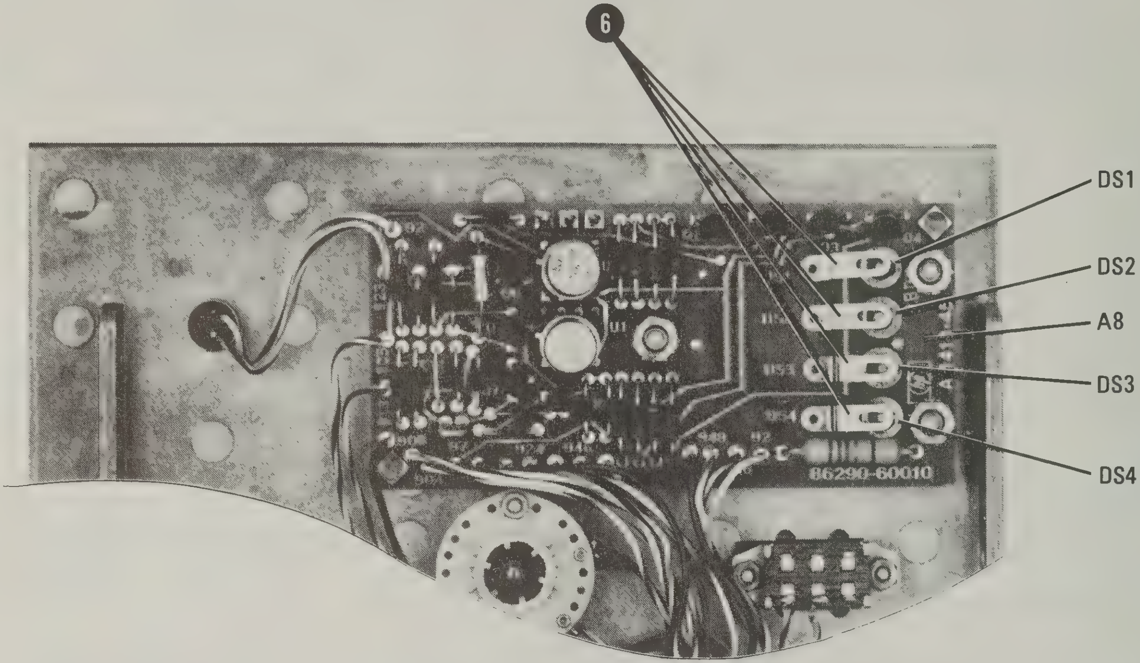


Figure 3-15. Band Indicator Lamp Replacement (1 of 2)

BAND INDICATOR LAMP REPLACEMENT (Cont'd)



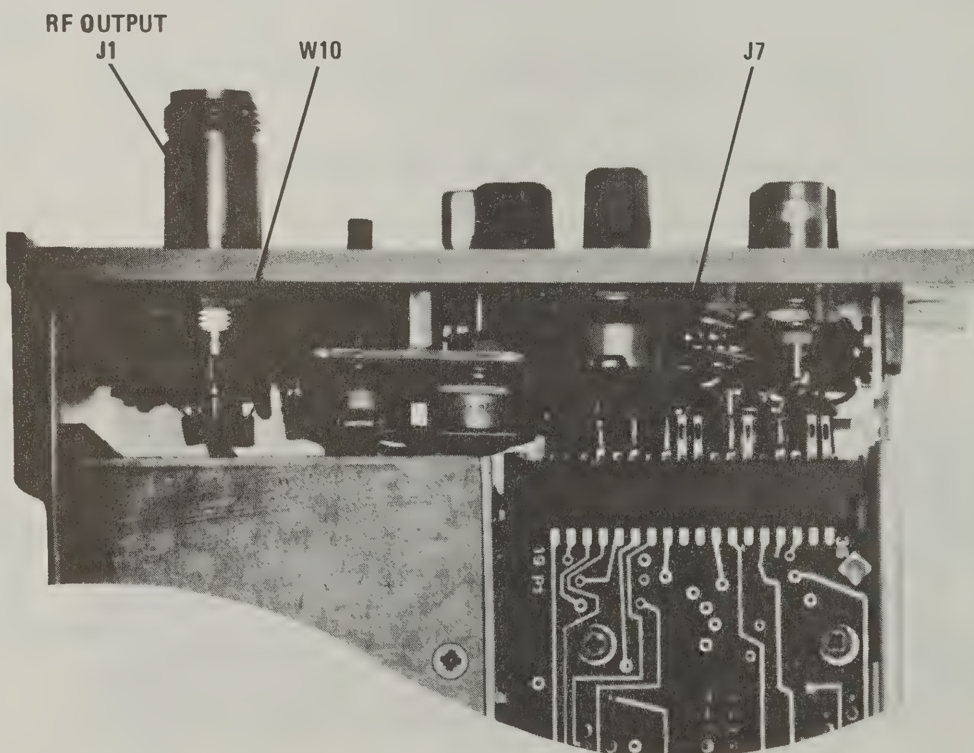


Figure 3-15. Band Indicator Lamp Replacement (2 of 2)

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Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER

over

5955-8108

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

____

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

____

If unit is part of system list model number(s) of other interconnected instruments. ______________

____

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

If unit is part of system list model number(s) of other interconnected instruments. ______________

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Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

If unit is part of system list model number(s) of other interconnected instruments. ______________

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Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

If unit is part of system list model number(s) of other interconnected instruments. ______________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

If unit is part of system list model number(s) of other interconnected instruments. ______________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ______________________________

Observed symptoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS______________

If unit is part of system list model number(s) of other interconnected instruments. ______________

9320-3896 Printed in U.S.A.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the instrument using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operator's Checks.

4-3. The performance test procedures must be performed in the sequence given, since some procedures rely on satisfactory test results in foregoing steps. If a test measurement is slightly out of tolerance, go to Section V and perform adjustment procedures. If a function fails to operate, go to Section VIII for troubleshooting information.

NOTE

In the following procedures an 8620C mainframe is specified; the 86290B will not operate with an 8620A or 8620B mainframe.

4-4. EQUIPMENT REQUIRED

4-5. Equipment required for the performance tests is listed in the Recommended Test Equipment table in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended models.

4-6. TEST RECORD

4-7. Results of the performance tests may be recorded in the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test Results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

PERFORMANCE TESTS

4-8. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Table 4-1. Frequency Range and Accuracy Specifications.

SPECIFICATION	BAND 1	BAND 2	BAND 3	BAND 4
Frequency Range:	2.0–6.2 GHz	6.0–12.4 GHz	12.0–18.6 GHz	2.0–18.6 GHz
Frequency Accuracy: (at 25° C)				
CW Mode (or Sweep Time > 0.1 sec with FM switch in PL or FM):	±20 MHz	±30 MHz	±30 MHz	±80 MHz
All sweep modes:	±30 MHz	±40 MHz	±40 MHz	±80 MHz
Marker:	±30 MHz	±30 MHz	±30 MHz	±80 MHz

PERFORMANCE TESTS

RELATED ADJUSTMENT: Paragraph 5-22, YTO FREQUENCY RANGE ADJUSTMENTS

DESCRIPTION:

CW mode accuracy is checked at three frequencies across each band. Manual sweep accuracy is checked at endpoints of each band. Swept frequency endpoint accuracy is checked in each band using a calibrated frequency meter. Specifications are shown in Table 4-1.

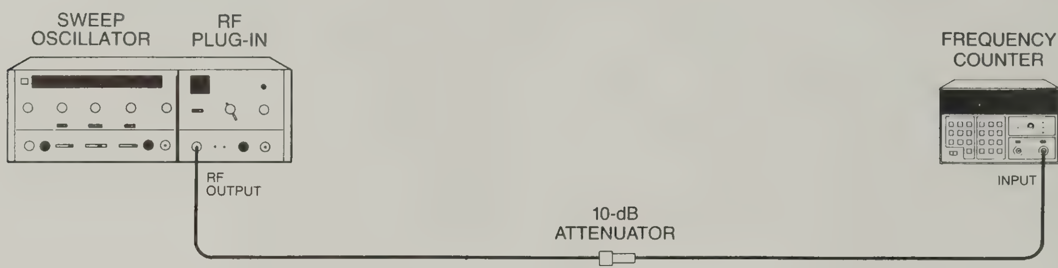


Figure 4-1. CW and Manual Sweep Accuracy Test Setup

NOTE

Equipment listed is for two test setups (Figure 4-1 and 4-2).

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Frequency Counter	HP 5343A
Oscilloscope	HP 1740A
Directional Coupler	HP 11691D, Option 001
Frequency Meter	HP 536A (0.96 – 4.2 GHz)
Frequency Meter	HP 537A (3.7 – 12.4 GHz)
Frequency Meter	HP P532A (12.4 – 18.0 GHz)
Frequency Meter	HP K532A (18.0 – 26.5 GHz)
Adapter (Type N (f) to Waveguide) (2 required)	HP P281C, Option 013 (for use with HP P532A)
Adapter (APC 3.5 (f) to Waveguide) (2 required)	HP K281C (for use with HP K532A
Adapter APC 3.5 (m) to N (f))	HP P/N 1250-1750
Adapter APC 3.5 (m) to N (m))	HP P/N 1250-1743
Crystal Detector	HP 8470B, Option 012
10-dB Attenuator	HP 8491B, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 4-1.

PERFORMANCE TESTS

b. Set controls as follows:

8620C:

BAND	Band 1
MODE	MANUAL
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise
RF BLANKING/OFF (rear panel)	RF BLANKING

86290B:

RF	ON
ALC	INT
POWER LEVEL	Twelve o'clock
FM-NORM-PL (rear panel)	FM

c. Press 8620C LINE pushbutton ON and allow 30 minutes warm-up time.

CW Mode Accuracy

d. Press 8620C CW pushbutton; pushbutton should light. Set 8620 CW MARKER pointer to low-frequency end of scale. Select Bands 1 through 4 and verify that frequency counter indicates frequencies shown in Table 4-2.

Table 4-2. CW Mode Accuracy at Low-Frequency Endpoints

BAND	CW MARKER POINTER	FREQUENCY COUNTER INDICATION
Band 1	2.0 GHz	2.000 GHz ±20 MHz
Band 2	6.0 GHz	6.000 GHz ±30 MHz
Band 3	12.0 GHz	12.000 GHz ±30 MHz
Band 4	2.0 GHz	2.000 GHz ±80 MHz

e. Set 8620C CW MARKER pointer to center-scale. Select Bands 1 through 4 and verify that frequency counter indicates frequencies shown in Table 4-3.

Table 4-3. CW Mode Accuracy at Mid-Frequencies

BAND	CW MARKER POINTER	FREQUENCY COUNTER INDICATION
Band 1	4.1 GHz	4.100 GHz ±20 MHz
Band 2	9.2 GHz	9.200 GHz ±30 MHz
Band 3	15.3 GHz	15.300 GHz ±30 MHz
Band 4	10.3 GHz	10.300 GHz ±80 MHz

PERFORMANCE TESTS

f. Set 8620C CW MARKER to high-frequency end of scale. Select Bands 1 through 4 and verify that frequency counter indicates frequencies shown in Table 4-4.

Table 4-4. CW Mode Accuracy at High-Frequency Endpoints

BAND	CW MARKER POINTER	FREQUENCY COUNTER INDICATION
Band 1	6.2 GHz	6.200 GHz ±20 MHz
Band 2	12.4 GHz	12.400 GHz ±30 MHz
Band 3	18.6 GHz	18.600 GHz ±30 MHz
Band 4	18.6 GHz	18.600 GHz ±80 MHz

Manual Sweep Accuracy

g. Press 8620C MARKER SWEEP pushbutton. Set MANUAL control fully counterclockwise. Set START MARKER Pointer to low-frequency end of scale. Select Bands 1 through 4 and verify that frequency counter indicates frequencies shown in Table 4-5.

Table 4-5. Manual Sweep Accuracy at Low-Frequency Endpoints

BAND	START MARKER POINTER	FREQUENCY COUNTER INDICATION
Band 1	2.0 GHz	2.000 GHz ±30 MHz
Band 2	6.0 GHz	6.000 GHz ±40 MHz
Band 3	12.0 GHz	12.000 GHz ±40 MHz
Band 4	2.0 GHz	2.000 GHz ±80 MHz

h. Set MANUAL CONTROL fully clockwise. Set STOP MARKER pointer to high-frequency end of scale. Select Bands 1 through 4 and verify that frequency counter indicates frequencies shown in Table 4-6.

Table 4-6. Manual Sweep Accuracy at High-Frequency Endpoints

BAND	STOP MARKER POINTER	FREQUENCY COUNTER INDICATION
Band 1	6.2 GHz	6.200 GHz ±30 MHz
Band 2	12.4 GHz	12.400 GHz ±40 MHz
Band 3	18.6 GHz	18.600 GHz ±40 MHz
Band 4	18.6 GHz	18.600 GHz ±80 MHz

PERFORMANCE TESTS

Swept Frequency Endpoint Accuracy

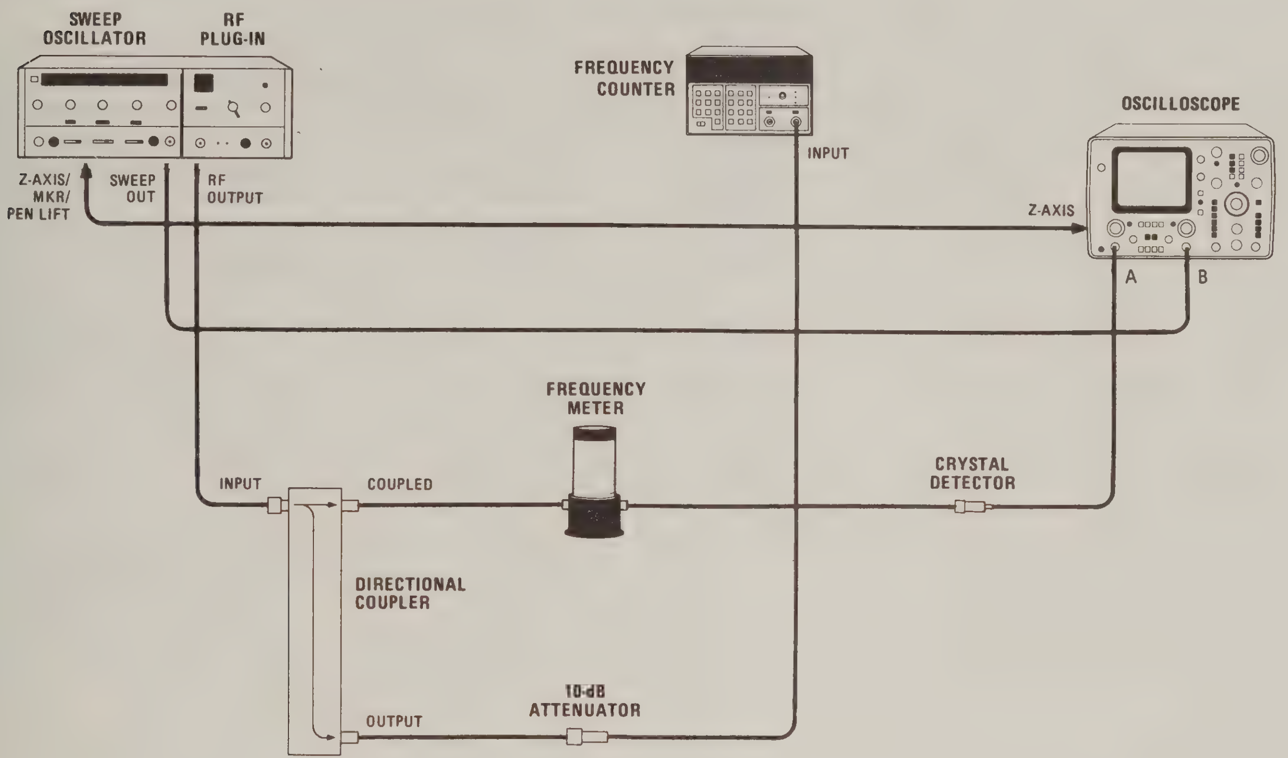


Figure 4-2. Swept Frequency Endpoint and Marker Accuracy Test Setup

i. Connect equipment as shown in Figure 4-2; use appropriate frequency meter for frequency being checked.

j. Set 8620C to Band 1. Press CW pushbutton. Adjust CW MARKER control for frequency counter indication of 2.000 GHz ±2 MHz.

k. Adjust frequency meter for minimum amplitude on oscilloscope. Note dial setting of frequency meter.

l. Press 8620C FULL SWEEP pushbutton, set MODE switch to AUTO.

m. Adjust frequency meter to low-frequency endpoint on oscilloscope. Determine the difference between end frequency and sweeper dial setting by subtracting this frequency meter setting from frequency meter setting noted in step k. This frequency difference must be less than 30 MHz.

n. Repeat steps i through m for bands and frequencies shown in Table 4-7.

PERFORMANCE TESTS

Table 4-7. Sweep Frequency Endpoint Accuracy Test

BAND	FREQUENCY	FREQUENCY TOLERANCE
Band 1	6.2 GHz	±30 MHz
Band 2	6.0 GHz	±40 MHz
Band 2	12.4 GHz	±40 MHz
Band 3	12.0 GHz	±40 MHz
Band 3	18.6 GHz	±40 MHz
Band 4	2.0 GHz	±80 MHz
Band 4	18.6 GHz	±80 MHz

Marker Accuracy

o. Set 8620C to Band 1. Press CW pushbutton. Adjust CW MARKER control for frequency counter indication of 4.1000 GHz ±2 MHz

p. Adjust frequency meter for minimum amplitude on oscillscope. Note dial setting of frequency meter.

q. Set 8620C START MARKER pointer to 3.0 GHz and STOP MARKER pointer to 5.0 GHz. Press MARKER SWEEP pushbutton. Set CW MARKER pointer to 4.1 GHz. Set MARKER switch to INTEN.

r. Adjust frequency meter to marker frequency on oscilloscope. Determine the difference between marker frequency and dial setting by subtracting this frequency from frequency meter setting in step p. Frequency difference must be less than 30 MHz.

s. Repeat steps o through r for the bands and frequencies shown in Table 4-8.

Table 4-8. Marker Accuracy Test

BAND	CW MARKER POINTER (MARKER FREQUENCY)	START MARKER POINTER	STOP MARKER POINTER	FREQUENCY TOLERANCE
Band 2	9.2 GHz	8.0 GHz	10.0 GHz	±30 MHz
Band 3	15.0 GHz	14.0 GHz	16.0 GHz	±30 MHz
Band 4	10.0 GHz	9.0 GHz	11.0 GHz	±80 MHz

4.9. FREQUENCY STABILITY TEST

SPECIFICATION:

Table 4-9. Frequency Stability Specifications

FREQUENCY STABILITY:	BAND 1	BAND 2	BAND 3	BAND 4
With 10% change in Line voltage:	± 100 kHz	± 100 kHz	± 100 kHz	± 100 kHz
With 10 dB power change from Maximum Leveled Power	± 1 MHz	± 2 MHz	± 3 MHz	± 3 MHz
With 3:1 load, SWR, all phases:	± 100 kHz	± 200 kHz	± 300 kHz	± 300 kHz
Residual FM (in 10 kHz bandwidth; FM-NORM-PL switch in NORM) CW Mode:	< ± 10 kHz	< ± 20 kHz	< ± 30 kHz	< ± 30 kHz

DESCRIPTION:

Frequency is measured for change due to line voltage, power, load, and residual FM.

PERFORMANCE TESTS

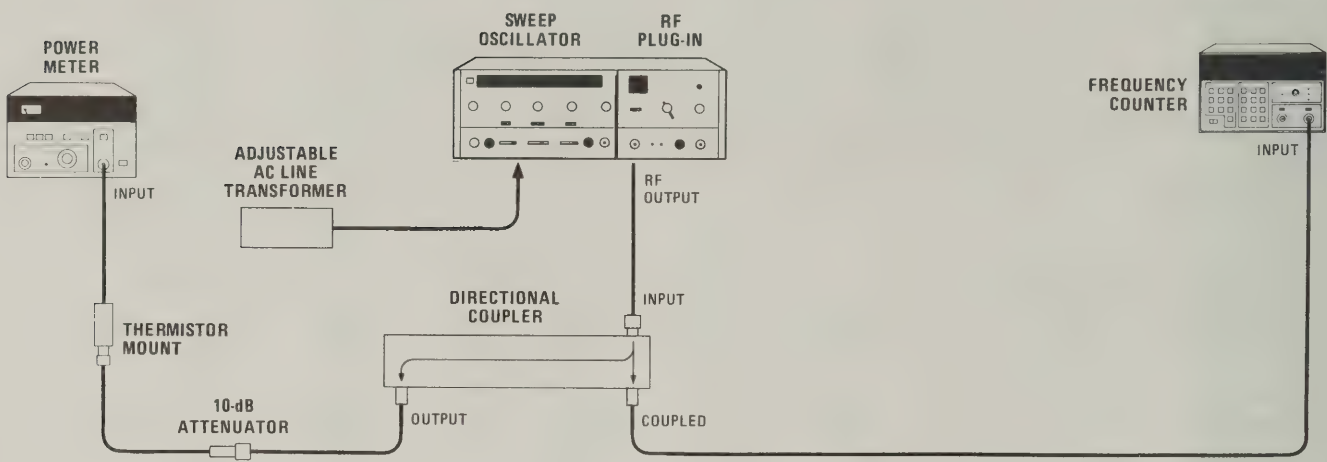


Figure 4-3. Frequency Stability Test Setup

NOTE

Equipment listed is for three test setups (Figures 4-3, 4-4, and 4-5).

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Frequency Counter	HP 5343A
Spectrum Analyzer	HP 8566A
Power Meter	HP 436A
Power Sensor	HP 8485A
Directional Coupler	HP 11691D, Option 001
Adjustable AC Line Transformer	General Radio MT3A
10-dB Attenuator	HP 8491B, Option 010
3-dB Attenuator	HP 8491B, Option 003
Adjustable Short	Maury Microwave 1953B

PROCEDURE:

Frequency Change with Line Voltage Change

a. Connect equipment as shown in Figure 4-3 and set 8620C LINE switch to ON. Set adjustable line transformer to 115 Vac. Allow 30 minutes warm-up time.

PERFORMANCE TESTS

b. Set controls as follows:

8620C:
BAND . . . . Band 1
TRIGGER . . . . INT

86290B:
RF . . . . ON
ALC . . . . INT
FM-NORM-PL (rear panel) . . . . NORM

c. Press 8620C CW pushbutton. Adjust 86290B POWER LEVEL control for maximum specified leveled power.

d. Set 8620C CW MARKER pointer to 4.1 GHz. Note frequency indication on counter with line voltage at 115 Vac.

e. Set line voltage to 103 Vac. Frequency change from that noted in step d should be less than ±100 kHz.

f. Set line voltage to 127 Vac. Frequency change from that noted in step d should be less than ±100 kHz.

g. Repeat steps d, e, and f for the bands and frequencies shown in Table 4-10.

Table 4-10. Frequency Change with Line Voltage Change

BAND	CW MARKER POINTER	FREQUENCY CHANGE
Band 2	9.2 GHz	<±100 kHz
Band 3	15.3 GHz	<±100 kHz
Band 4	10.3 GHz	<±100 kHz

Frequency Change with Power Level Change

h. Set 8620C to Band 1 and CW MARKER pointer to 4.1 GHz. Set line voltage to 115 Vac. Adjust 86290B POWER LEVEL control for a leveled output power of +10 dBm. Note frequency indication on counter.

i. Decrease 86290B power by 10 dB as indicated on power meter. Frequency change from that noted in step h should be less than ±1 MHz.

j. Repeat steps h and i for the bands and frequencies shown in Table 4-11.

PERFORMANCE TESTS

Table 4-11. Frequency Change with Power Level Change

BAND	CW MARKER POINTER	FREQUENCY CHANGE
Band 2	9.2 GHz	<±2 MHz
Band 3	15.3 GHz	<±3 MHz
Band 4	10.3 GHz	<±3 MHz

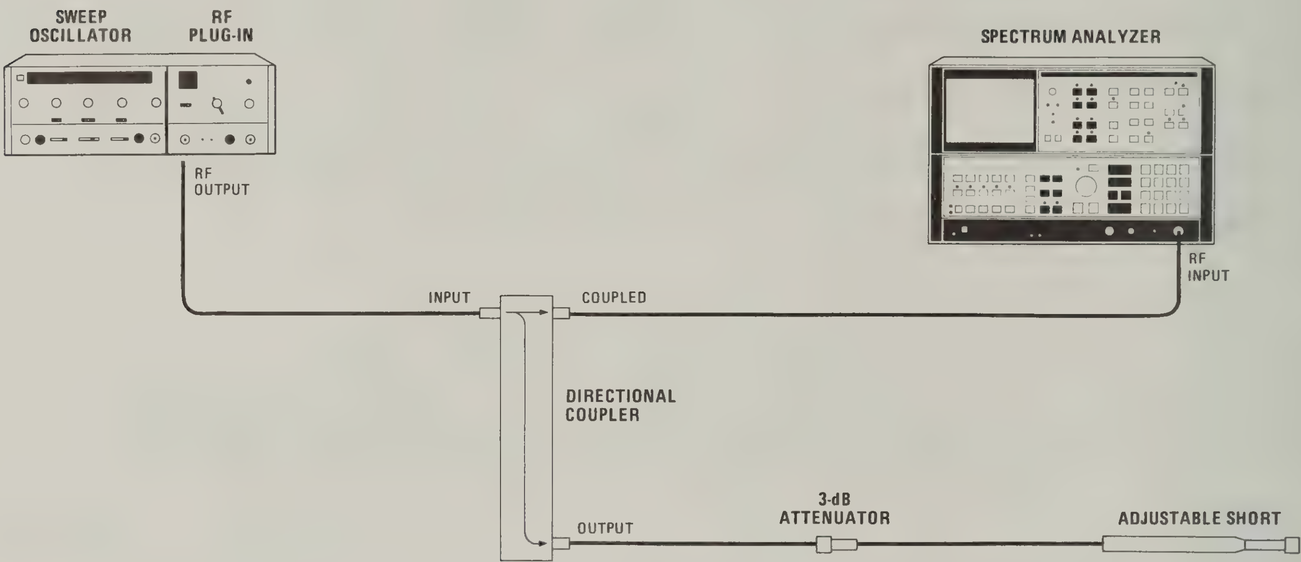


Figure 4-4. 3:1 Load SWR Test Setup

k. Connect equipment as shown in Figure 4-4. Allow 30 minutes warm-up time. Set controls as follows:

8620C:
BAND . . . . Band 1
CW MARKER Pointer . . . . 4.1 GHz

86290B:
RF . . . . ON
ALC . . . . INT
FM-NORM-PL (rear panel) . . . . NORM

l. Press 8620C CW pushbutton. Adjust 86290B for a leveled output power of +10 dBm.

m. Center output signal on Spectrum Analyzer display. Set frequency span to 500 kHz.

PERFORMANCE TESTS

n. Adjust the adjustable short through its range while observing the frequency change on analyzer. Frequency change must be less than −100 kHz.

o. Repeat steps m and n for the bands and frequencies shown in Table 4-12.

Table 4-12. Frequency Change with 3:1 Load SWR

BAND	CW MARKER POINTER	FREQUENCY CHANGE
Band 2	9.2 GHz	<±200 kHz
Band 3	15.3 GHz	<±300 kHz
Band 4	10.3 GHz	<±300 kHz

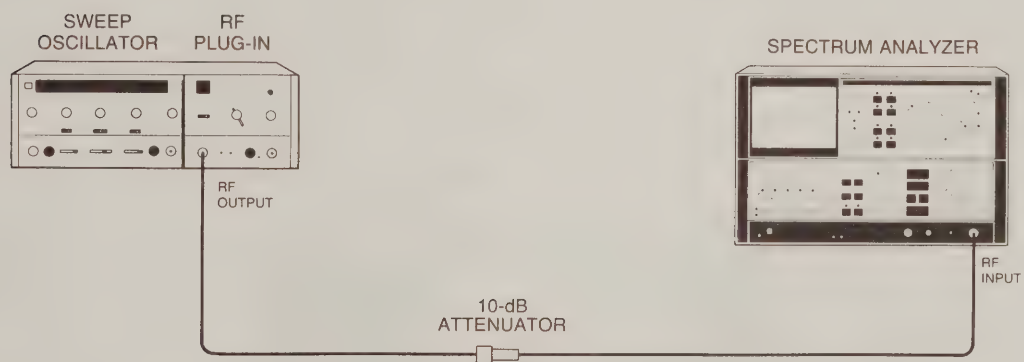


Figure 4-5. Residual FM Test Setup

p. Connect equipment as shown in Figure 4-5. Allow 30 minutes warm-up time. Set controls as follows:

8620C:
BAND . . . . Band 1
CW MARKER Pointer . . . . 4.1 GHz

86290B:
RF . . . . ON
ALC . . . . INT
FM-NORM-PL (rear panel) . . . . NORM

q. Press 8620C CW pushbutton. Center RF output signal on Spectrum Analyzer display. Set Spectrum Analyzer frequency span to 100 kHz.

PERFORMANCE TESTS

r. Spectrum analyzer display should be similar to Figure 4-6. Frequency deviation measured across top of trace should be less than 10 kHz peak (20 kHz peak-to-peak).

s. Repeat steps q and r for the bands and frequencies shown in Table 4-13.

Table 4-13. Residual FM Frequency Deviation

BAND	CW MARKER POINTER	MAXIMUM DEVIATION
Band 2	9.2 GHz	20 kHz peak
Band 3	15.3 GHz	30 kHz peak
Band 4	10.3 GHz	30 kHz peak

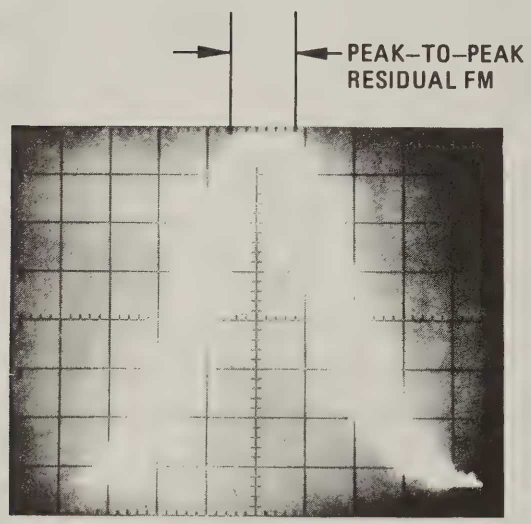


Figure 4-6. Residual FM Displayed on Spectrum Analyzer

PERFORMANCE TESTS

4-10. POWER LEVEL AND VARIATION TEST

SPECIFICATION:

Table 4-14. Power Level and Power Variation Specifications

SPECIFICATION	BAND 1	BAND 2	BAND 3	BAND 4
Maximum Leveled Power (25°C):	>+10 dBm	>+10 dBm	>+10 dBm	>+10 dBm
Maximum Leveled Power (Option 004)	>+9.5 dBm	>+9.5 dBm	>+9.5 dBm	>+9.5 dBm
Power Variations (at specified maximum leveled power):				
Internally Leveled	<±0.7 dB	<±0.7 dB	<±0.8 dB	<±0.9 dB
Internally Leveled (Option 004)	<±0.8 dB	<±0.8 dB	<±0.9 dB	<±1.0 dB
Crystal Detector Leveled (External)[1]	<±0.15 dB	<±0.15 dB	<±0.15 dB	<±0.15 dB
Power Meter (External)[2]	<±0.15 dB	<±0.15 dB	<±0.15 dB	<±0.15 dB

[1]Excluding coupler and detector variations.
[2]Use HP Model 432A Power Meter: sweep duration >10 seconds.

RELATED ADJUSTMENT:

Paragraph 5-23, YTM SLOW SPEED TRACKING ADJUSTMENTS and Paragraph 5-27, ALC ADJUSTMENTS:

DESCRIPTION:

Maximum leveled power is measured with a power meter. Power level variations with internal leveling, crystal detector leveling, and power meter leveling are checked. In each mode, the power variations are measured on the oscilloscope. The trace is calibrated by changing the RF output power by the amount of the specification as noted on the power meter and the corresponding change in the oscilloscope trace position.

In the internal leveling test, the oscilloscope is calibrated with the power meter, then the oscillator output is routed through a crystal detector to the oscilloscope vertical input. Removing the thermistor sensor and directional coupler from the test setup eliminates errors due to frequency response variations in these devices. In the external leveling modes, the frequency response variations do not affect the oscilloscope display because the leveling variations are monitored in the feedback loop. However, the usable RF power output from the directional coupler will have level variations as a result of the frequency response characteristics of the thermistor sensor, crystal detector, and directional coupler.

PERFORMANCE TESTS

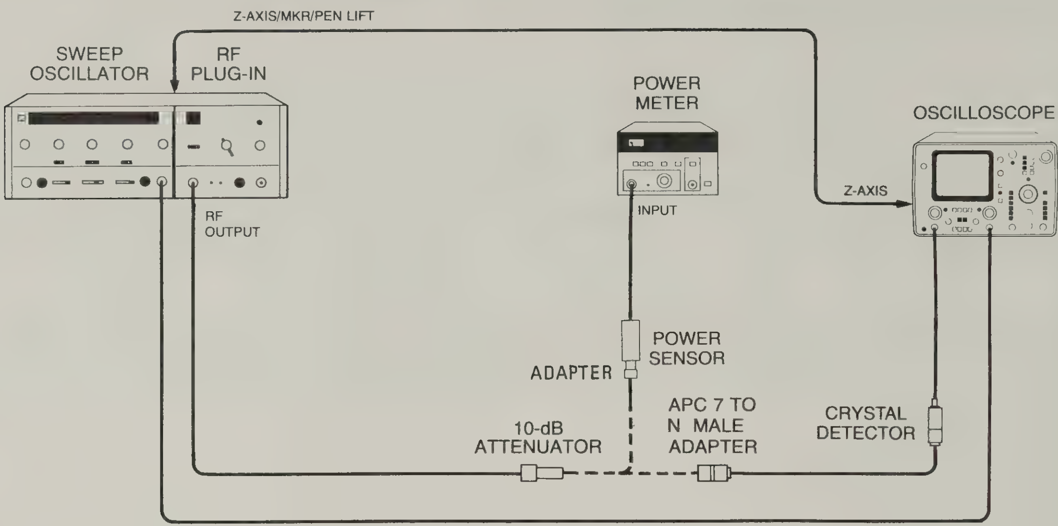


Figure 4-7. Internal Leveling Test Setup

NOTE

Equipment listed is for three test setups (Figures 4-7, 4-8 and 4-9).

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
Power Meter	HP 432A
Thermistor Sensor and 10-dB Attenuator	HP 8478B, H32
Power Meter	HP 436A
Power Sensor	HP 8485A
10-dB Attenuator	8491B, Option 010
Directional Couplers	HP 11691D, Option 001
Crystal Detector	HP 8470B, Option 012
BNC TEE	HP P/N 1250-0781
Adapter (APC 3.5 (f) to N (m))	HP P/N 1250-1744

PROCEDURE:

a. Connect equipment as shown in Figure 4-7 with RF OUTPUT connected to the oscilloscope. Set controls as follows:

8620C:

BAND	Band 1
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	DISPLAY BLANKING

PERFORMANCE TESTS

86290B:

RF	ON
ALC	INT
FM-NORM-PL (rear panel)	FM

b. Press 8620C LINE ON and select FULL SWEEP. Select A vs B on the 1740A and adjust for a full display. Allow 30 minutes warm-up time.

c. Adjust 86290B POWER LEVEL and PEAK controls for maximum leveled power as indicated on oscillscope.

Internal Leveling

NOTE

The following procedure assumes the use of a standard 86290B. If an Option 004 86290B is being tested, subtract 0.5 dB from Maximum Leveled Power specification and add 0.1 dB to internal leveling power variation specifications as indicated in Table 4-14.

d. Connect equipment as shown in Figure 4-7 with RF OUTPUT connected to power sensor and power meter.

e. Press 8620C CW pushbutton. Slowly rotate CW MARKER control through entire range while observing power meter reading. Minimum power should be greater than +10 dBm. Note minimum power point reading.

f. Adjust CW MARKER control to minimum power point as observed on power meter. Set 86290B POWER LEVEL control fully counterclockwise and note power meter indication. This reading should be at least 10 dB below minimum power point reading in step e. Adjust power to +10.0 dBm ±0.1 dB.

g. Connect equipment as shown in Figure 4-7 with RF OUTPUT connected to crystal detector and oscilloscope. Adjust oscilloscope to establish +10 dBm reference on top horizontal graticule.

h. Connect equipment as shown in Figure 4-7 with RF OUTPUT connected to power sensor and power meter. Adjust 86290B power to +11.4 dBm −0.1 dB. (It may be necessary to change frequency.)

i. Connect equipment as shown in Figure 4-7, with RF output connected to crystal detector and oscilloscope. Note 11.4 dBm reference point on oscilloscope. Area between this trace position and top graticule line represents leveling to tolerance.

j. Press 8620C FULL SWEEP pushbutton. Adjust 86290B until minimum power point (upper point of trace) coincides with reference line established in step g. Lower point of trace (maximum power point) should be above reference point established in step h.

NOTE

If power variation does not meet specification in step j, use the power meter to check level of maximum and minimum power points. Additional power variation may be introduced by the crystal detector causing the power variation specification not to be met.

k. Repeat steps h through j for each band listed in Table 4-15, using the reference power listed to establish leveling tolerance in step h.

PERFORMANCE TESTS

Table 4-15. Internal Leveling Power Level and Variation

BAND	REFERENCE POWER
Band 2	+11.4 dBm
Band 3	+11.6 dBm
Band 4	+11.8 dBm

Crystal Detector Leveling

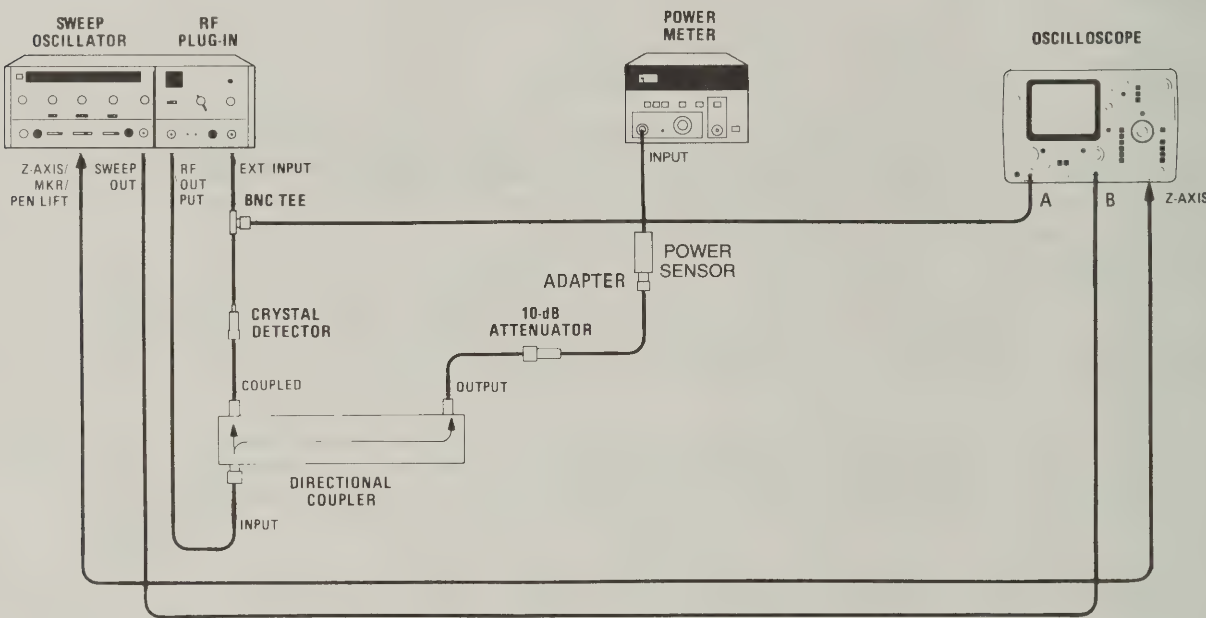


Figure 4-8. Crystal Detector Leveling Test Setup

1. Connect equipment as shown in Figure 4-8. Allow 30 minutes warm-up time.

NOTE

The HP 8470B Crystal Detector has a negative output.

m. Set controls as follows:

8620C:

BAND	Band 4
CW MARKER Pointer	10.0 GHz
MARKERS	INTEN
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	DISPLAY BLANKING

PERFORMANCE TESTS

86290B:

RF . . . . ON
ALC . . . . EXT
ACL GAIN . . . . Midrange
SLOPE-OFF . . . . OFF

n. Turn the 86290B POWER LEVEL control fully clockwise. Press the 8620C FULL SWEEP pushbutton. Position the marker on the 8620C to the minimum power point as observed on the oscilloscope.

o. Press the 8620C CW pushbutton. Adjust the 86290B POWER LEVEL control for a +10 dBm indication on the power meter.

p. Adjust oscilloscope vertical control to position the dot to the center graticule of the oscilloscope. Adjust the 86290B POWER LEVEL control for a power increase of 0.3 dB as observed on the power meter. The area between this trace position and the center graticule represents a leveling tolerance of ±0.15 dB. Reset minimum power point to +10 dBm.

q. Press 8620C FULL SWEEP pushbutton. The minimum power point should be on the center graticule. The highest point of the trace should be within the leveled variation limit established in step p.

Power Meter Leveling

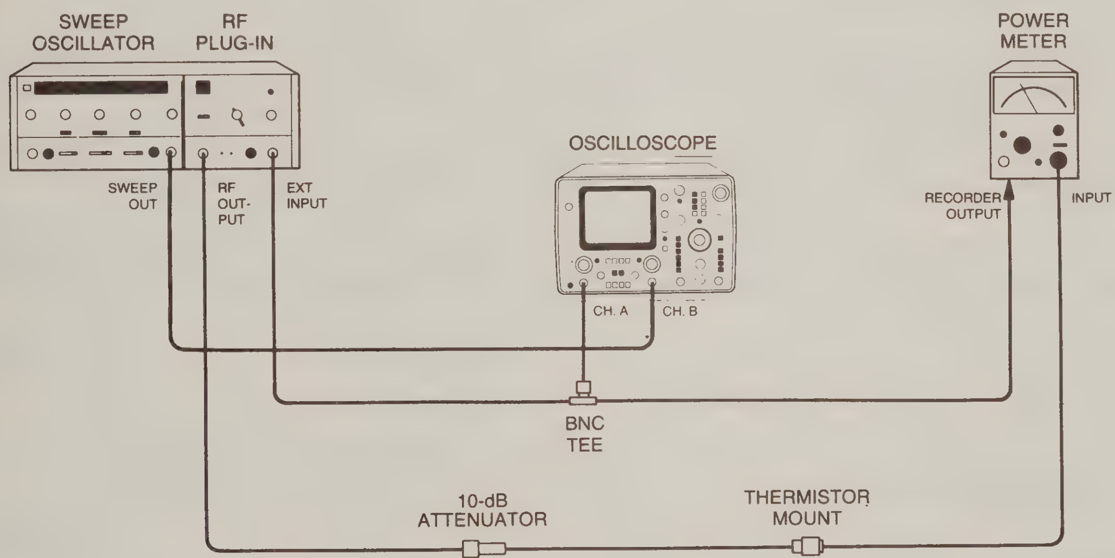


Figure 4-9. Power Meter Leveling Test Setup

r. Connect equipment as shown in Figure 4-9. Allow 30 minutes warm-up time.

NOTE

The HP 432A Power Meter has a positive output.

PERFORMANCE TESTS

s. Set controls as follows:

8620C:

BAND	Band 4
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	100 – 10
TIME-SECONDS Vernier	Midrange
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	DISPLAY BLANKING

86290B:

RF	ON
ALC	MTR
ACL GAIN	Midrange

NOTE

For power meter leveling, sweep rates slower than 10 sec/sweep should be used to ensure proper leveling due to the slow response time of the thermistor sensor.

t. Turn the 86290B POWER LEVEL control fully clockwise. Press the 8620C FULL SWEEP pushbutton. Position the marker on the 8620C to the minimum power point as observed on the oscilloscope.

u. Press the 8620C CW pushbutton. Adjust the 86290B POWER LEVEL control for a +10 dBm as observed on the power meter. Set the power meter range for indication in the upper half of the scale.

v. Press the 8620C FULL SWEEP pushbutton. (Note sweep rate limitation of the thermistor sensor.) Observe minimum and maximum power meter readings. Total variations should not exceed 0.3 dB.

4-11. RESIDUAL AM TEST

SPECIFICATION:

AM noise in a 100 kHz bandwidth (below fundamental at specified maximum leveled power): >55 dB.

DESCRIPTION:

The carrier signal from the 86290B Plug-In is amplitude modulated with a square wave from the 8620C Sweep Oscillator. The modulated signal is used to establish a reference on the RMS Voltmeter that is 9 dB below the actual carrier signal. The 9-dB reduction occurs because of the voltmeter response to a square wave and the square-law response of the crystal detector. The modulation is removed and the magnitude of the Residual AM component is measured with respect to the established reference.

PERFORMANCE TESTS

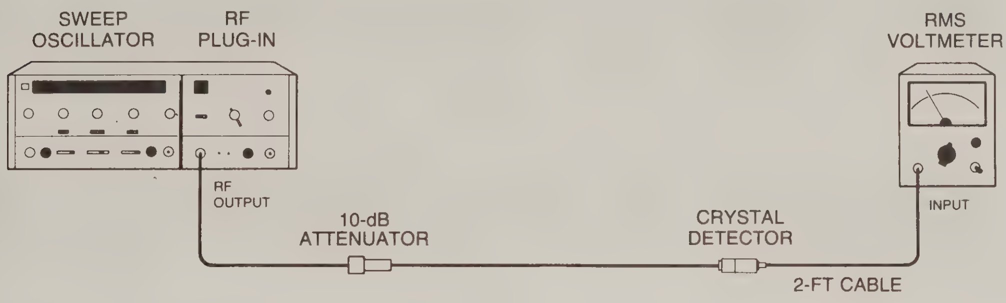


Figure 4-10. Residual AM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
RMS Voltmeter	HP 3400A
10-dB Attenuator	HP 8491B, Option 010
Crystal Detector	HP 8470B, Option 012
2-foot BNC to BNC Cable	HP 11086A

PROCEDURE:

a. Connect equipment as shown in Figure 4-10. Allow 30 minutes warm-up time. Set controls as follows:

8620C:

BAND	Band 4
CW MARKER Pointer	10.0 GHz
1 kHz SQ WV/OFF (rear panel)	1 kHz SQ WV
RF BLANKING/OFF (rear panel)	RF BLANKING

86290B:

RF	ON
ALC	INT

b. Adjust 86290B for maximum specified leveled power. Press CW pushbutton.

NOTE

Any CW frequency between 2.0 GHz and 18.6 GHz may be used for this test.

c. Set RMS voltmeter to a range that gives an on-scale indication. Note meter indication.

PERFORMANCE TESTS

d. Set 8620C rear-panel 1 kHz SQ WV/OFF switch to OFF. Set RMS voltmeter to a range that gives an on-scale reading. The difference between this reading and the reading in step c should be a minimum of 46 dB.

NOTE

A 46-dB decrease in the RMS voltmeter indication corresponds to a 55-dB reduction in signal value. A correction factor of 9 dB is added because of the RMS voltmeter response to a square wave and the square-law response of the crystal detector.

4-12. SPURIOUS SIGNALS TEST

SPECIFICATION:

Test is measured in dB below fundamental at specified maximum power, 2.0 – 18.6 GHz.

Harmonically Related Signals . . . . >25 dB
Nonharmonics . . . . >50 dB

DESCRIPTION:

The RF signal is displayed on a spectrum analyzer to verify spurious signal output is down from the fundamental frequency by the specified amount.

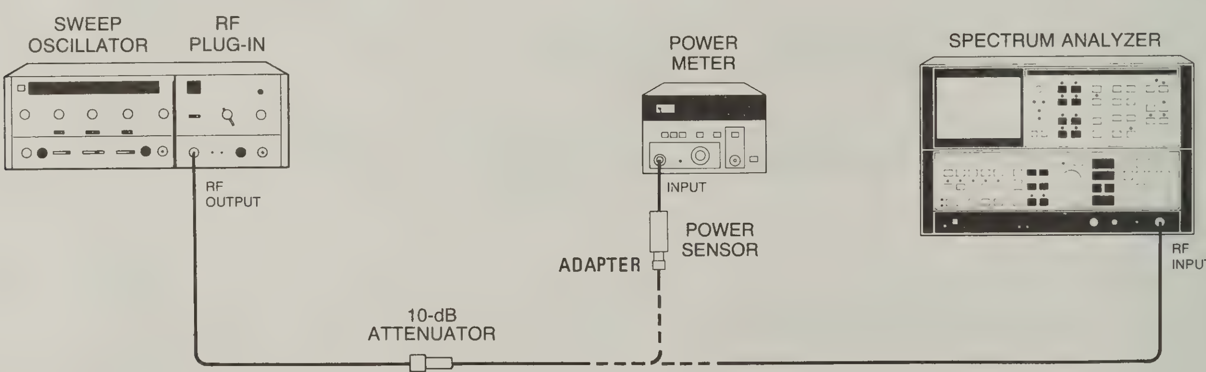


Figure 4-11. Spurious Signals, Test Setup

EQUIPMENT:

Sweep Oscillator . . . . HP 8620C
RF Plug-In . . . . HP 86290B
Spectrum Analyzer . . . . HP 8566A
Power Meter . . . . HP 436A
Power Sensor . . . . HP 8485A
10-dB Attenuator . . . . HP 8491B, Option 010
Adapter (APC 3.5 (f) to N (m)) . . . . HP P/N 1250-1744

PERFORMANCE TESTS

PROCEDURE:

a. Connect Power Meter as shown in Figure 4-11. Allow 30 minutes warm-up time.

b. Set controls as follows:

8620C:
BAND 4
MODE . . . . MANUAL

86290B:
RF . . . . ON
ALC . . . . INT
FM-NORM-PL (rear panel) . . . . NORM

c. Adjust 86290B for leveled power with minimum power point set to +10 dBm (+9.5 dBm for Option 004).

d. Connect spectrum analyzer input through 10-dB attenuator to 86290B RF OUTPUT connector. Adjust spectrum analyzer reference level to place fundamental signal on top horizontal graticule.

e. Rotate MANUAL control through its entire range while observing spectrum analyzer display from 2.0 GHz to 18.6 GHz. All harmonically-related signals should be greater than 25 dB down from fundamental and all non-harmonic-related signals should be down greater than 50 dB.

NOTE

The spectrum analyzer can originate some mixing products that can appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB, then return the attenuator to the original position. If the signal in question originates in the spectrum analyzer, the level will change by some amount other than 10 dB.

4-13. EQUIVALENT SOURCE SWR TEST

SPECIFICATION:

SWR: <1.9 (for all bands, internally leveled, 50-ohm nominal impendance 2 – 18 GHz)

DESCRIPTION:

The wideband 86290B RF output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal from the Plug-In contains (1) the initial signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows: the original oscilloscope signal travels down the 10-cm airlines, sees the open, and is reflected back to the source. If the reflected signal going into the RF OUTPUT connector sees a perfect 50-ohm source match, no signal is reflected back out of the source. However, the greater the mismatch, the greater the reflected signal. The reflected signal adds and subtracts in and out of phase with the original oscillator signal and is displayed on the oscilloscope.

PERFORMANCE TESTS

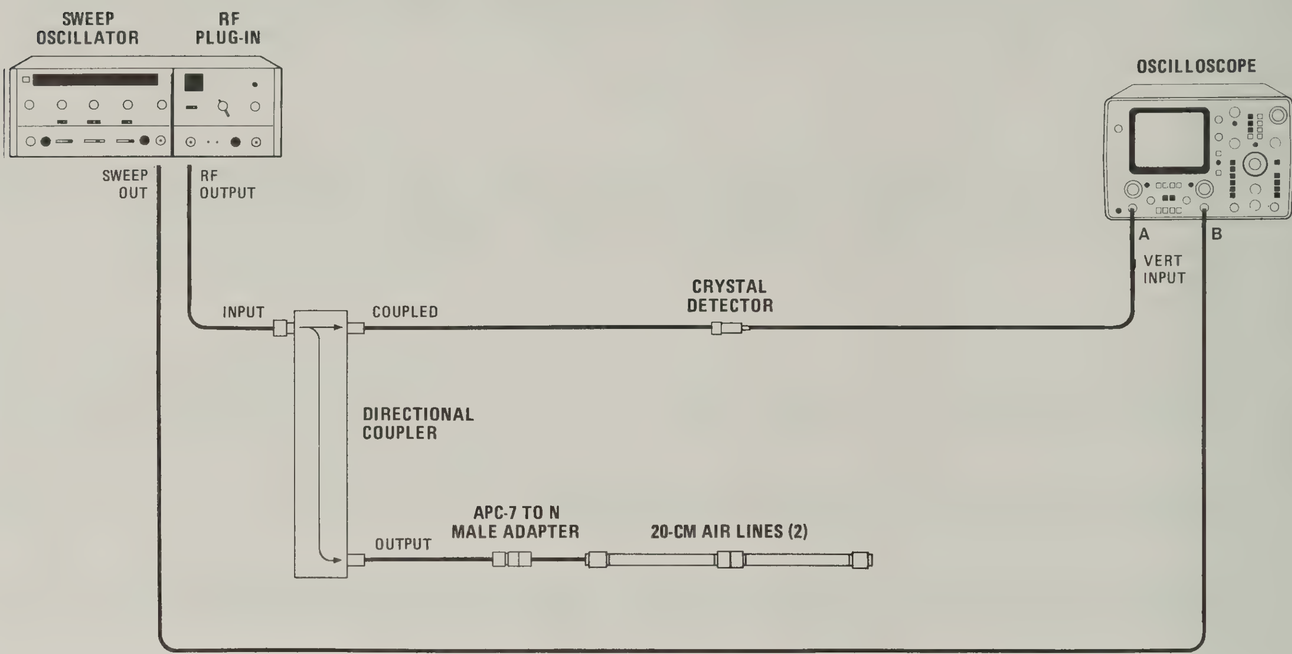


Figure 4-12. Equivalent Source Match SWR Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
Crystal Detector	HP 8470B, Option 012
Directional Coupler	HP 11691D, Option 001
20-cm Air Lines (2 required)	HP 11567A
APC-7 to N Male Adapter	HP 11525A

PERFORMANCE TESTS

PROCEDURE:

a. Connect equipment as shown in Figure 4-12. Allow 30 minutes warm-up time. Set controls as follows:

8620C:

BAND	Band 4
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise
DISPLAY BLANKING/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING

86290B:

RF	ON
ALC	INT

b. Press 8620C MARKER SWEEP pushbutton. Adjust the 8620C START MARKER for 2.0 GHz and STOP MARKER for 18.0 GHz. Adjust 86290B for leveled power and <25 mV maximum deflection as observed on oscilloscope to ensure square-law ouput of crystal detector.

c. Display swept power output trace on oscilloscope (Figure 4-13). Select largest V MAX/V MIN ratio on oscilloscope display and convert it to source SWR, using Figure 4-14. The SWR should be <1.9.

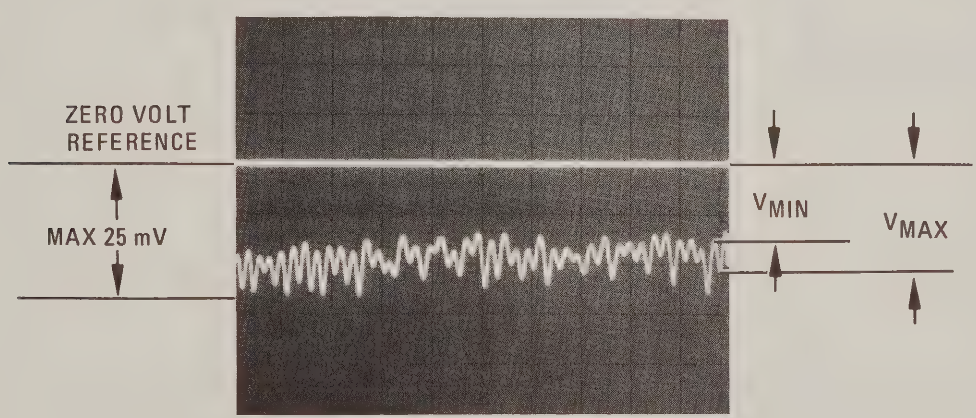


Figure 4-13. Typical Pattern of a Swept SWR Measurement

PERFORMANCE TESTS

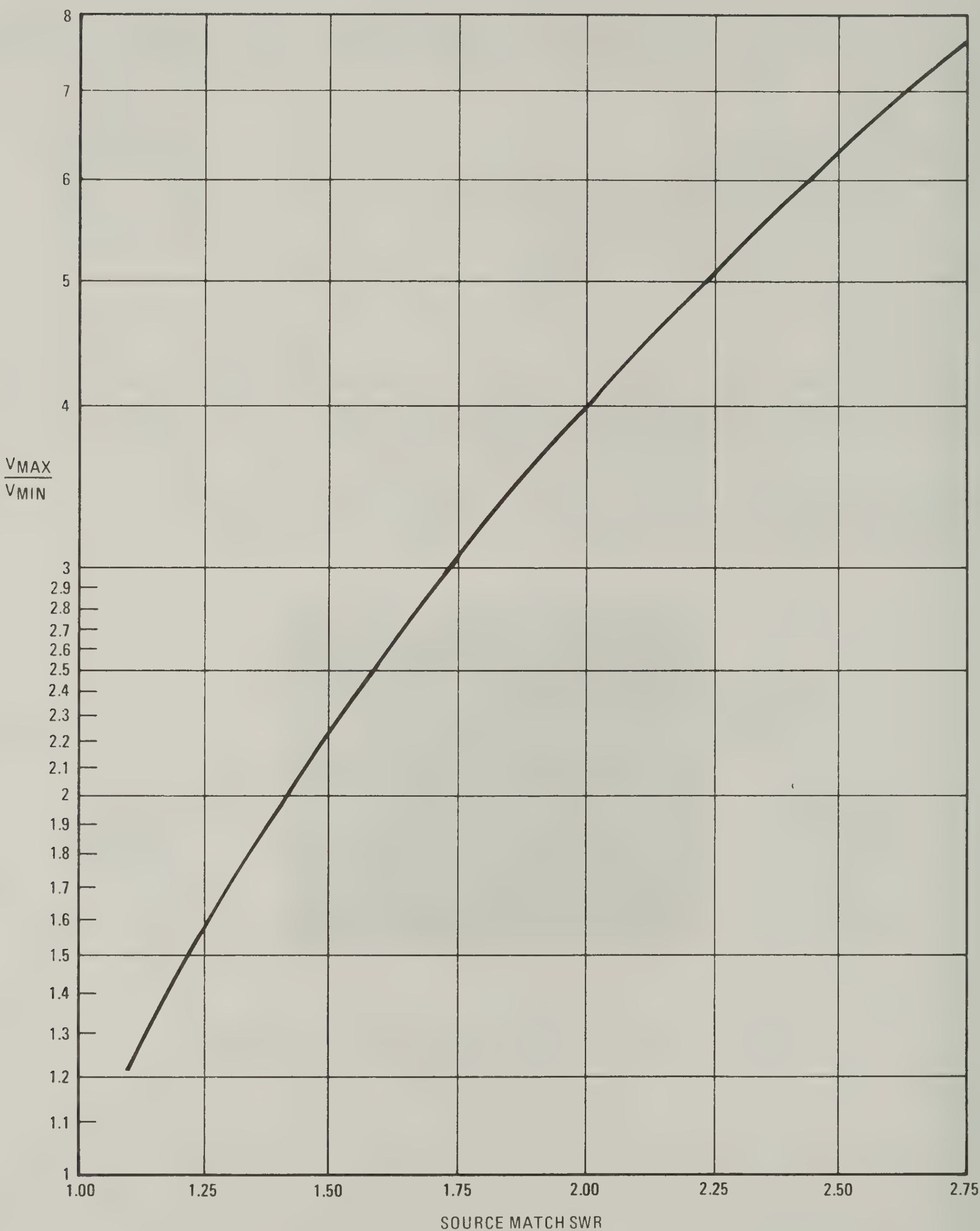


Figure 4-14. Graph for Converting Oscilloscope Trace to Source Match SWR

PERFORMANCE TESTS

4-14. EXTERNAL FREQUENCY MODULATION TEST

SPECIFICATION:

(86290B FM-NORM-PL Switch in FM position)

Modulation Frequencies	Maximum Deviation
DC to 100 Hz	±75 MHz
100 Hz to 2 MHz	±5 MHz

RELATED ADJUSTMENT:

Paragraph 5-19, FREQUENCY MODULATION BALANCE ADJUSTMENT.

DESCRIPTION:

The 86290B is modulated by an external signal source at 10 Hz, 100 Hz, 900 kHz, and 2.1 MHz. Deviation from low modulation frequencies (10 Hz and 100 Hz) is measured directly by the spectrum analyzer. Deviation from high modulation frequencies (900 kHz and 2.1 MHz) is measured on the spectrum analyzer using the carrier-null method.

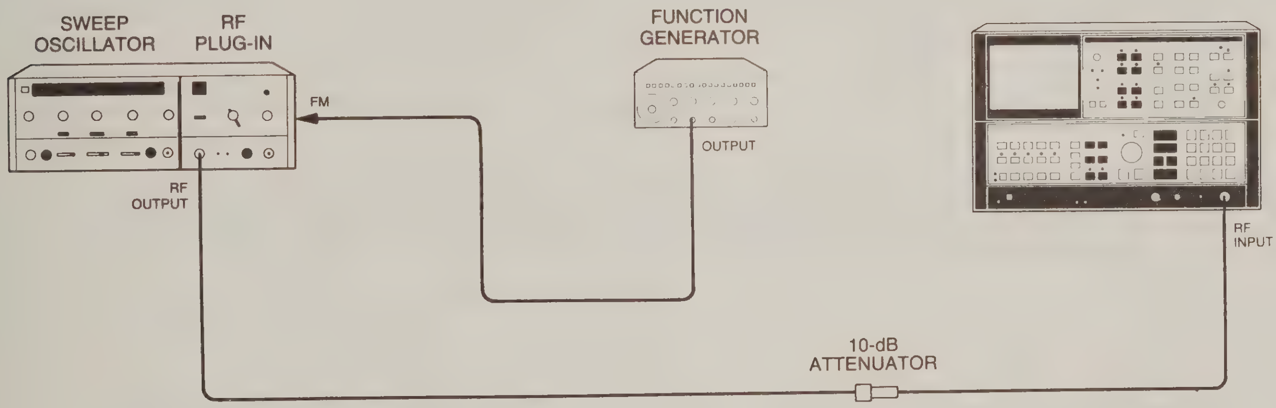


Figure 4-15. External Frequency Modulation Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Function Generator	HP 3312A
Spectrum Analyzer	HP 8566A
10-dB Attenuator	HP 8491B, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 4-15. Set 8620C LINE switch ON and allow 30 minutes warm-up time.

PERFORMANCE TESTS

b. Set controls as follows:

8620C:

BAND	Band 1
CW MARKER Pointer	4.1 GHz
RF BLANKING/OFF (rear panel)	RF BLANKING

86290B:

RF	ON
ALC	INT
FM-NORM-PL (rear panel)	FM

c. Press 8620C CW pushbutton. Adjust 86290B for specified maximum leveled power. Set function generator frequency to 10 Hz and amplitude to minimum.

d. Set spectrum analyzer Frequency Span to 500 MHz

Low Frequency FM

e. Adjust spectrum analyzer to center RF carrier on display. Increase function generator amplitude while observing spectrum analyzer display.

NOTE

As modulation amplitude is increased, the trace will have linear deviation as shown in Figure 4-16. Excessive modulation amplitude will cause non-linear deviation as shown in Figure 4-17.

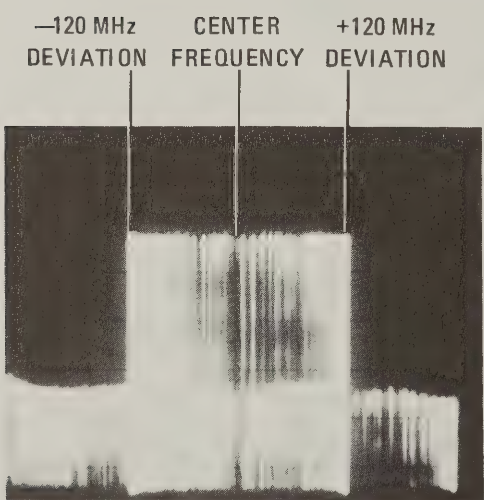


Figure 4-16. Spectrum Analyzer Display of Linear Frequency Modulation

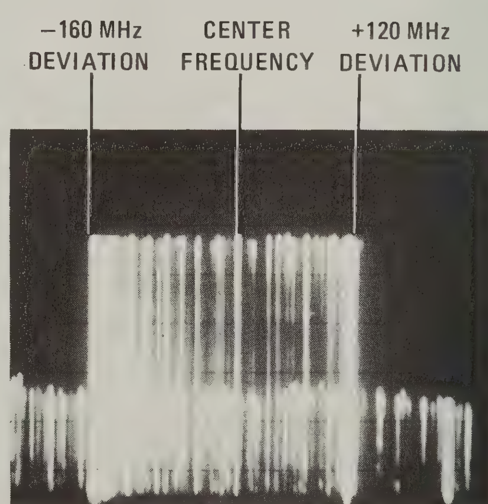


Figure 4-17. Spectrum Analyzer Display of Non-linear Frequency Modulation

PERFORMANCE TESTS

f. Adjust frequency generator amplitude to produce maximum linear deviation as shown on spectrum analyzer. Deviation should be greater than ±75 MHz.

g. Set function generator frequency to 100 Hz. Adjust function generator amplitude to produce maximum linear deviation. Deviation should be greater than ±75 MHz.

h. Repeat steps c through g for the bands and frequencies shown in Table 4-16.

High Frequency FM

i. Set controls as follows:

8620C:
BAND . . . . Band 1
CW MARKER Pointer . . . . 4.1 GHz

j. Adjust 86290B for maximum specified leveled power. Set function generator Frequency Span to 10 MHz.

k. Set spectrum analyzer bandwidth to 30 kHz and scan width to 1 MHz/division.

l. Adjust spectrum analyzer to center RF carrier on display. Increase function generator amplitude while observing spectrum analyzer display. Sidebands will appear and carrier amplitude will start to decrease. Increase function generator amplitude through first carrier null and up to second carrier null as shown in Figure 4-18. This point is ±5 MHz deviation.

m. Set function generator frequency to 2.1 MHz and amplitude to minimum. Increase function generator amplitude to produce first carrier null as shown in Figure 4-19. This point is ±5 MHz deviation.

n. Repeat steps j through m for bands and frequencies shown in Table 4-17.

Table 4-16. Low Frequency FM

BAND	CW FREQUENCY
Band 2	9.2 GHz
Band 3	15.3 GHz
Band 4	10.3 GHz

Table 4-17. High Frequency FM

BAND	CW FREQUENCY
Band 2	9.2 GHz
Band 3	15.3 GHz
Band 4	10.3 GHz

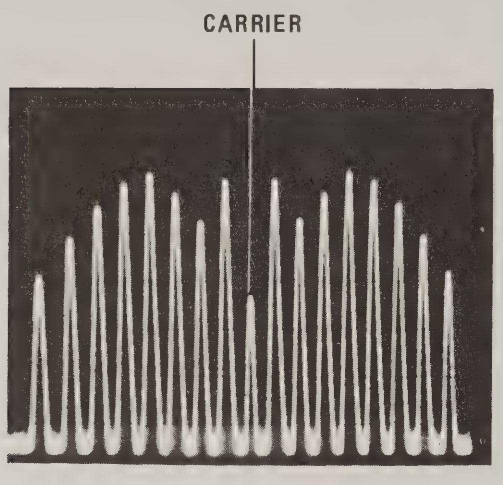


Figure 4-18. Spectrum Analyzer Display of Second Carrier-Null with 900 kHz Modulation Frequency

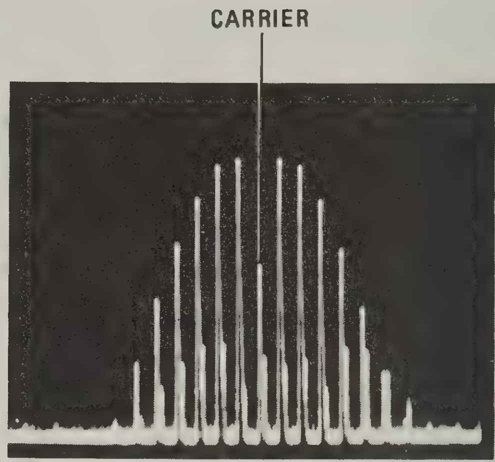


Figure 4-19. Spectrum Analyzer Display of First Carrier-Null with 2.1 MHz Modulation Frequency

4-15. AMPLITUDE MODULATION TEST

SPECIFICATION:

All tests are referenced to the 86290B RF OUTPUT power set to the specified maximum power of +10 dBm (+9.5 dBm for Option 004).

Internal AM:
- RF Blanking (Selected by RF BLANKING/OFF switch) ON/OFF ratio >30dB
- 1 kHz Square Wave (Selected by 1 kHz SQ WV/OFF switch) ON/OFF ratio >25 dB

External AM:
- 27.8 kHz, ±6V Square Wave ON/OFF ratio >30 dB
- Symmetry 45/55
- Attenuation for +5 Vdc Input >30 dB

RELATED ADJUSTMENT:

Paragraph 5-27 or 5-28, ALC ADJUSTMENTS.

DESCRIPTION

Internal AM is checked for RF blanking and 1 kHz square wave modulation on/off ratios. The ON/OFF ratio is determined by power level measurement in the ON and OFF conditions. External AM is checked with 27.8 kHz, ±6V square wave to ensure compatibility with the HP 8755A Swept Amplitude Analyzer. Sensitivity is checked by applying +5 Vdc and checking the resulting attenuation.

PERFORMANCE TESTS

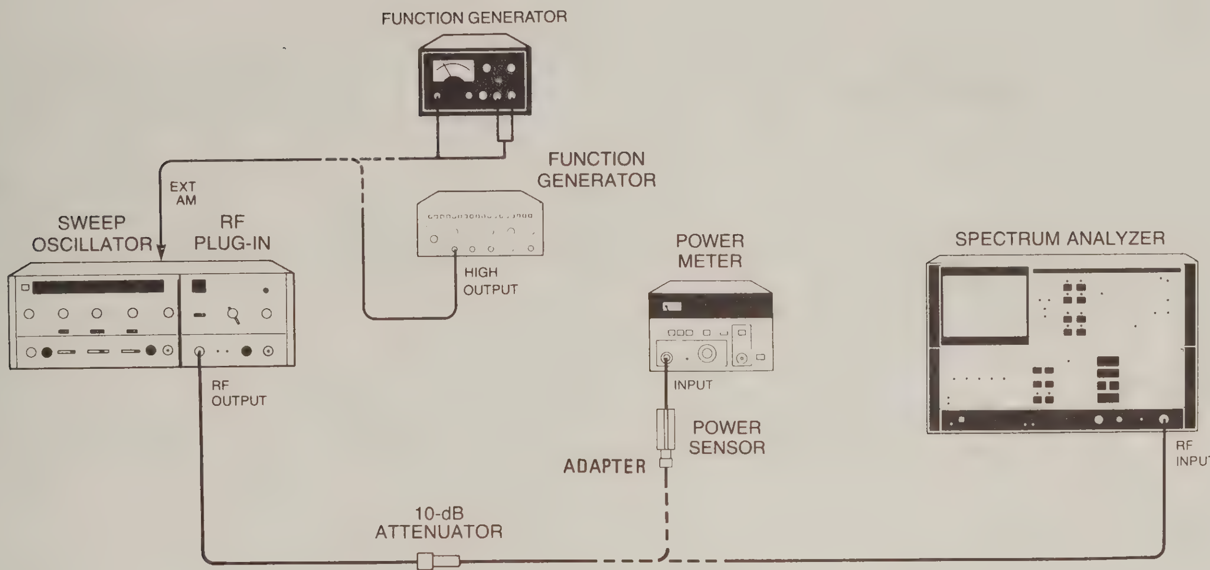


Figure 4-20. Amplitude Modulation Test Setup

EQUIPMENT:

Adapter (APC 3.5(f) to N(m))	HP P/N 1250-1744
Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
DC Power Supply	HP 6214A
Power Meter	HP 436A
Power Sensor	HP 8485A
Spectrum Analyzer	HP 8566A
Oscilloscope	HP 1740A
Power Splitter	HP 11667A
BNC Tee	HP 1250-0781
Function Generator	HP 3312A

PERFORMANCE TESTS

PROCEDURE:

a. Connect equipment as shown in Figure 4-20 with DC Power Supply connected to EXT AM. Allow 30 minutes warm-up time.

b. Set controls as follows:

8620C:

BAND	Band 4
CW MARKER Pointer	10.0 GHz
ΔF Pointer	0.0 MHz
ΔF Multiplier	X 0.1
MODE	AUTO
TRIGGER	INT
TIME–SECONDS	.1 – .01
TIME–SECONDS Vernier	Fully clockwise
RF BLANKING/OFF (rear panel)	OFF

86290B:

ALC Function Switch A1S1 Position 4	Up
ALC Function Switch A1S1 Position 5	Down

RF Blanking

c. Set power supply and function generator for zero output. Press 8620CW pushbutton. Adjust 86290B for +10 dBm output power (+9.5 dBm for Option 004).

d. Set 8620C MODE switch to AUTO, TRIGGER switch to EXT, and RF BLANKING/OFF switch (rear panel) to OFF. Press 8620C FULL SWEEP pushbutton.

e. Set spectrum analyzer bandwidth to 10 kHz, scan width to 20 MHz/division, scan time to 5 ms/division, and display sensitivity to 10 dB/division.

f. Adjust spectrum analyzer to center RF carrier on display. Set reference level on spectrum analyzer. Set 8620C RF BLANKING/OFF switch to RF Blanking and note difference in power level (ON/OFF ratio). ON/OFF ratio should be greater than 30 dB. Set RF BLANKING/OFF switch to OFF.

+5 Attenuation

g. Check reference level on spectrum analyzer. Set power supply to +5 Vdc and note difference in power level (attenuation). Attenuation should be greater than 30 dB. Disconnect power supply from 8620C.

1 kHz Square Wave

h. Calibrate oscilloscope for 10 dB/division sensitivity.

NOTE

The HP 8552B Spectrum Analyzer IF Section Vertical Output is calibrated to 10 dB/0.1 Vdc.

PERFORMANCE TESTS

i. Set 8620C 1 kHz SQ WV/OFF switch to 1 kHz SQ WV. Set spectrum analyzer bandwidth to 300 kHz and scan width to zero. Note difference in power levels of ON and OFF periods as shown on oscilloscope. ON/OFF ratio should be greater than 25 dB. Set 8620C 1 kHz SQ WV/OFF switch to OFF.

27.8 kHz Square Wave

j. Connect Function Generator to 8620C EXT AM input. Set Function Generator for 27.8 kHz and adjust for ±6V output as shown on oscilloscope. Note difference in power levels of ON and OFF periods as shown on oscilloscope. ON/OFF RATIO should be >30 dB.

Symmetry

k. Observe ON period to OFF period ratio on oscilloscope. ON/OFF symmetry should be >45/55.

Table 4-18. Performance Test Record (1 of 5)

Hewlett-Packard Model 86290B RF Plug-In Serial Number:		Test Performed By: ______ Date: ______		

PARA. NO.	DESCRIPTION	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-8.	**FREQUENCY RANGE AND ACCURACY TEST**			
	CW Mode Accuracy			
	d. CW MARKER set to low-frequency of each band (Table 4-2).			
	Band 1	1.980 GHz	______	2.020 GHz
	Band 2	5.970 GHz	______	6.030 GHz
	Band 3	11.970 GHz	______	12.030 GHz
	Band 4	1.920 GHz	______	2.080 GHz
	e. CW MARKER pointer set to middle of each band (Table 4-3).			
	Band 1	4.080 GHz	______	4.120 GHz
	Band 2	9.170 GHz	______	9.230 GHz
	Band 3	15.270 GHz	______	15.330 GHz
	Band 4	10.220 GHz	______	10.380 GHz
	f. CW MARKER pointer set to high-frequency end of each band (Table 4-4).			
	Band 1	6.180 GHz	______	6.220 GHz
	Band 2	12.370 GHz	______	12.430 GHz
	Band 3	18.570 GHz	______	18.630 GHz
	Band 4	18.520 GHz	______	18.680 GHz
	Manual Sweep Accuracy			
	g. START MARKER pointer at low-frequency end of each band (Table 4-5).			
	Band 1	1.970 GHz	______	2.030 GHz
	Band 2	5.960 GHz	______	6.040 GHz
	Band 3	11.960 GHz	______	12.040 GHz
	Band 4	1.920 GHz	______	2.080 GHz

Table 4-18. Performance Test Record (2 of 5)

PARA. NO.	DESCRIPTION	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-8.	**FREQUENCY RANGE AND ACCURACY TEST (Cont'd)**			
	h. STOP MARKER pointer at high-frequency end of each band (Table 4-6).			
	Band 1	6.170 GHz	________	6.230 GHz
	Band 2	12.360 GHz	________	12.440 GHz
	Band 3	18.560 GHz	________	18.640 GHz
	Band 4	18.520 GHz	________	18.680 GHz
	Sweep Frequency Endpoint Accuracy (Table 4-7).			
	m. Band 1 LO		________	±30 MHz
	n. Band 1 HI		________	±30MHz
	Band 2 LO		________	±40MHz
	Band 2 HI		________	±40MHz
	Band 3 LO		________	±40MHz
	Band 3 HI		________	±40MHz
	Band 4 LO		________	±80MHz
	Band 4 HI		________	±80MHz
	Marker Accuracy (Table 4-8).			
	r. Band 1	4.070 GHz	________	4.130 GHz
	s. Band 2	9.170 GHz	________	9.230 GHz
	Band 3	14.970 GHz	________	15.030 GHz
	Band 4	9.920 GHz	________	10.080 GHz
4-9.	**FREQUENCY STABILITY TEST**			
	Frequency Change with Line Voltage			
	e. Line voltage 130 Vac (Table 4-10).			
	Band 1	−100 kHz	________	+100 kHz
	Band 2	−100 kHz	________	+100 kHz
	Band 3	−100 kHz	________	+100 kHz
	Band 4	−100 kHz	________	+100 kHz

Table 4-18. Performance Test Record (3 of 5)

PARA. NO.	DESCRIPTION	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-9.	**FREQUENCY STABILITY TEST (Cont'd)**			
	f. Line voltage 127 Vac (Table 4-10).			
	Band 1	−100 kHz	______	+100 kHz
	Band 2	−100 kHz	______	+100 kHz
	Band 3	−100 kHz	______	+100 kHz
	Band 4	−100 kHz	______	+100 kHz
	Frequency Change with Power Level Change (Table 4-11).			
	i. Band 1	−1 MHz	______	+1 MHz
	j. Band 2	−2 MHz	______	+2 MHz
	Band 3	−3 MHz	______	+3 MHz
	Band 4	−3 MHz	______	+3 MHz
	Frequency Change with 3:1 Load SWR (Table 4-12).			
	n. Band 1	−100 kHz	______	+100 kHz
	o. Band 2	−200 kHz	______	+200 kHz
	Band 3	−300 kHz	______	+300 kHz
	Band 4	−300 kHz	______	+300 kHz
	Residual FM (Table 4-13).			
	r. Band 1		______	±10 kHz
	s. Band 2		______	±20 kHz
	Band 3		______	±30 kHz
	Band 4		______	±30kHz
4-10.	**POWER LEVEL AND VARIATION TEST**			
	Internal Leveling			
	d. CW minimum power.	+10.0 dBm		
	j. Internal Leveling variation (Table 4-15).			
	Band 1		______	±0.7 dB
	Band 2		______	±0.7 dB
	Band 3		______	±0.8 dB
	Band 4		______	±0.9 dB
	Crystal Detector Leveling			
	q. Variation limits.		______	±0.15 dB

Table 4-18. Performance Test Record (4 of 5)

PARA. NO.	DESCRIPTION	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-10.	**POWER LEVEL AND VARIATION TEST (Cont'd)**			
	Power Meter Leveling			
	v. Variation limits.		______	+0.15 dB
4-11.	**RESIDUAL AM TEST**			
	d. Below fundamental at specified maximum power.	55 dB	______	
4-12.	**SPURIOUS SIGNALS TEST**			
	e. Harmonically related signals.	25 dB	______	
	e. Nonharmonics.	50 dB	______	
4-13.	**EQUIVALENT SOURCE SWR TEST**			
	c. Source match SWR, 2–18 GHz.		______	1.9
4-14.	**EXTERNAL FREQUENCY MODULATION TEST**			
	Low Frequency FM (Table 4-16).			
	f. Deviation with 100 Hz modulation Frequency.			
	Band 1	±75 MHz	______	
	Band 2	±75 MHz	______	
	Band 3	±75 MHz	______	
	Band 4	±75 MHz	______	
	g. Deviation with 100 Hz modulation frequency.			
	Band 1	±75 MHz	______	
	Band 2	±75 MHz	______	
	Band 3	±75 MHz	______	
	Band 4	±75 MHz	______	

Table 4-18. Performance Test Record (5 of 5)

PARA. NO.	DESCRIPTION	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14.	**EXTERNAL FREQUENCY MODULATION TEST (Cont'd)**			
	High Frequency FM (Table 4-17.)			
	l. Deviation with 900 Hz modulation frequency (Figure 4-18).			
	Band 1	Correct Waveform	__________	
	Band 2	Correct Waveform	__________	
	Band 3	Correct Waveform	__________	
	Band 4	Correct Waveform	__________	
	m. Deviation with 2.1 MHz modulation frequency (Figure 4-19).			
	Band 1	Correct Waveform	__________	
	Band 2	Correct Waveform	__________	
	Band 3	Correct Waveform	__________	
	Band 4	Correct Waveform	__________	
4-15.	**AMPLITUDE MODULATION TEST**			
	e. RF Blanking ON/OFF Ratio	30 dB	__________	
	ON/OFF Ratio			
	i. 1 kHz SQ WV	30 dB	__________	
	27.8 kHz square wave	30 dB	__________	
	j. Symmetry	40%	__________	60%
	n. +5V Attenuation	30 dB	__________	

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 86290B RF Plug-In. These procedures should not be performed as a routine maintenance procedure, but should be used (1) after replacement of a part or component, or (2) when performance tests show that the specifications of Table 1-1 cannot be met. Before attempting any adjustment, allow 30 minutes warm-up time for the instrument. Table 5-1 lists the adjustment controls and the function of each control. The Factory Selected Components are listed in reference designator order in Table 5-2.

5-3. EQUIPMENT REQUIRED

5-4. Table 1-4 lists the equipment required for the adjustment procedure. If the test equipment recommended is not available, other equipment may be used if its performance meets the "Critical Specifications" listed in the table. The test setup used for an adjustment procedure is referenced in each procedure.

5-5. FACTORY SELECTED COMPONENTS

5-6. Factory selected components are identified with an asterisk on the schematic diagram. The range of their values and functions are listed in Table 5-2. Selection of their values is covered in the adjustment procedures. Exact values of the components selected for the YTM and YTO assemblies are recorded on the RF Section casting.

5-7. SAFETY CONSIDERATIONS

5-8. Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition (see Section I). Service and adjustments should be performed only by qualified service personnel.

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal could make this instrument dangerous. Intentional interruption is prohibited.

5-9. Any adjustment, maintenance, or repair of the opened instrument under voltage should be avoided as much as possible but, when necessary, should be performed only by skilled persons who are aware of the hazard involved.

5-10. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

5-11. Make sure that only fuses of the required current rating and of the specified type (normal blow, time delay, etc.) are used for replacement. Do not use repaired fuses or shortcircuited fuse-holders.

5-12. Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

WARNING

Adjustments described are performed with power supplied to the instrument while protective covers are removed. Energy available at many points can, if contacted, cause personal injury. Any adjustments made with the protective covers removed should be performed only by trained service personnel.

5-13. RELATED ADJUSTMENTS

5-14. Interactive control adjustments are noted in the procedures. Table 5-3 indicates by paragraph numbers the adjustments that must be performed if an assembly has been replaced or repaired, or if an adjustment has been made on an assembly.

OSCILLATOR

S/N______________

IS INSTALLED IN THIS INSTRUMENT. SELECTED VALUES FOR A3 YTO DRIVER BOARD ARE:

R 46______________

R 47______________

R 48______________

R 49______________

R 59______________

MADE IN U.S.A.

MULTIPLIER

S/N______________

IS INSTALLED IN THIS INSTRUMENT. SELECTED VALUES FOR A2 YTM DRIVER BOARD ARE:

R 60______________

R 65______________

R 73______________

R 74______________

R 76______________

R 79______________

MADE IN U.S.A.

R F ALIGNMENT PROCEDURE

NOTE: This is an abbreviated procedure. For complete adjustment procedures, see Section V in Operating and Service Manual. Allow 30 minute warmup before adjustment. For tracking adjustment only, go directly to step 2.

1. FREQUENCY ACCURACY, A3 BOARD ADJUSTMENTS

Monitor AUX OUT frequency with counter. Select specified band. Adjust CW and CW VERNIER for indicated voltage between 86290B A5TP1 and 8620C A4 GND REF. Adjust specified controls at top of A3 board for indicated AUX OUT frequency. Always adjust LO control first.

BAND	A5TP1 (VOLTS)	A3 BOARD ADJUSTMENTS	AUX OUT FREQUENCY
1	0.000	Band 1 LO	2.000 GHz
1	10.000	Band 1 HI	6.200 GHz
2	0.000	Band 2 LO	3.000 GHz
2	10.000	Band 2 HI	6.200 GHz
3	0.000	Band 3 LO	4.000 GHz
3	10.000	Band 3 HI	6.000 GHz

2. TRACKING, A2 BOARD ADJUSTMENTS

Set PEAK control to mechanical center. Monitor unleveled RF OUTPUT power with swept display or power meter. Select BAND 1, 2.0 - 6.2 GHz, and adjust BAND 1 LO control at top of A2 board for maximum power over lower portion of band. Then adjust BAND 1 HI control for maximum power over upper portion of band. Repeat procedure for BAND 2 and BAND 3. Always adjust LO control first.

MADE IN U.S.A.

Figure 5-1. RF Section Labels for YTO and YTM Factory Selected Components and Abbreviated RF Alignment Procedure

Table 5-1. Controls Listed in Adjustment Sequence (1 of 2)

Adj. Para.	Ref. Des.	Schematic Name	Function
5-19	A4R16	BAL	Adjusts for zero frequency offset.
5-20	A5R1	OFFSET ADJ	Adjusts for zero frequency control voltage offset at low end of Band 1.
5-20	A5R2	BAND 1 HI	Adjusts for frequency control voltage of 10.000 Vdc at high end of Band 1.
5-20	A5R4	BAND 2 B	Adjusts frequency control voltage in Band 2.
5-20	A5R3	BAND 2 A	Adjusts frequency control voltage in Band 2.
5-20	A5R6	BAND 3 B	Adjusts frequency control voltage in Band 3.
5-20	A5R5	BAND 3 A	Adjusts frequency control voltage in Band 3.
5-21	A6R2	LO	Adjusts 6.2 GHz switchpoint.
5-21	A6R6	HI	Adjusts 12.4 GHz switchpoint.
5-22	A3R44	ZERO	Adjusts Band Switch Amplifier A3U2 offset voltage.
5-22	A3R4	BAND 1 LO	Adjusts low-end frequency of Band 1.
5-22	A3R8	BAND 2 LO	Adjusts low-end frequency of Band 2.
5-22	A3R26	BAND 3 LO	Adjusts low-end frequency of Band 3.
5-22	A3R3	BAND 1 HI	Adjusts high-end frequency of Band 1.
5-22	A3R7	BAND 2 HI	Adjusts high-end frequency of Band 2.
5-22	A3R25	BAND 3 HI	Adjusts high-end frequency of Band 3.
5-23	A2R27	ZERO	Adjusts Band Switch Amplifier A2U1 offset voltage.
5-23	A2R2	BAND 1 LO	Adjusts for maximum power at low-end of Band 1.
5-23	A2R1	BAND 1 HI	Adjusts for maximum power across Band 1.
5-23	A2R4	BAND 2 LO	Adjusts for maximum power at low end of Band 2.
5-23	A2R3	BAND 2 HI	Adjusts for maximum power across Band 2.
5-23	A2R39	BAND 2 LO BIAS	Adjusts for maximum power at low end of Band 2.
5-23	A2R38	BAND 2 HI BIAS	Adjusts for maximum power across Band 2.
5-23	A2R6	BAND 3 LO	Adjusts for maximum power at low end of Band 3.
5-23	A2R5	BAND 3 HI	Adjusts for maximum power across Band 3.
5-23	A2R41	BAND 3 LO BIAS	Adjusts for maximum power at low end of Band 3.
5-23	A2R40	BAND 3 HI BIAS	Adjusts for maximum power across Band 3.
5-25	A10A1R4	OFFSET	Adjusts YTM Bias for maximum power in Bands 2 and 3.
5-26	A2R32	M_O	Adjusts magnitude of delay compensation offset.
5-26	A2R31	M_S	Adjusts magnitude of delay compensation slope.
5-26	A2R25	t_S	Adjusts risetime of delay compensation slope.

Table 5-1. Controls Listed in Adjustment Sequence (2 of 2)

Adj. Para.	Ref. Des.	Schematic Name	Function
5-26	A2R26	t_o	Adjusts risetime of delay compensation offset.
5-26	A3R20	M_{o1}	Adjusts magnitude of delay compensation offset in Band 1.
5-26	A3R21	M_{s1}	Adjusts magnitude of delay compensation slope in Band 1.
5-26	A3R6	t_{s1}	Adjusts risetime of delay compensation slope in Band 1.
5-26	A3R5	t_{o1}	Adjusts risetime of delay compensation offset in Band 1.
5-26	A3R34	M_{o3}	Adjusts magnitude of delay compensation offset in Band 3.
5-26	A3R35	M_{s3}	Adjusts magnitude of delay compensation slope in Band 3.
5-26	A3R28	t_{s3}	Adjusts risetime of delay compensation slope in Band 3.
5-26	A3R27	t_{o3}	Adjusts risetime of delay compensation offset in Band 3.
5-26	A2R55	COMP BREAK POINT	Adjusts frequency at which fade-in compensation is activated.
5-26	A2R57	COMP MAG	Adjusts magnitude of fade-in compensation.
5-26	A2R67	TIME 2	Adjusts for sweep speed related power variations in Band 2 portion of Band 4.
5-26	A2R68	TIME 3	Adjusts for sweep speed related power variation in Band 3 portion of Band 4.
5-27	A1R60	SYMMETRY	Sets lower limit of closed loop operation for ALC.
5-27	A1R7	LO LEVEL CLAMP	Sets power at maximum CCW setting of front-panel POWER LEVEL control.
5-27	A1R29	F1	Adjusts flatness at low end of band.
5-27	A1R36	G1	Adjusts flatness at low end of band.
5-27	A1R42	F2	Adjusts flatness at high end of band.
5-27	A1R55	G2	Adjusts flatness at high end of band.
5-27	A1R75	PIN UPPER CLAMP	Sets maximum available current to modulator.
5-27	A1R71	GAIN SHAPING	Adjusts flatness across band with no oscillations.
5-27	A1R10	UPPER POWER CLAMP	Sets power at most CW setting of front-panel POWER LEVEL control with internal A1S1 position #3 OFF (Down).
5-27	A1R59	GAIN PRESET	Sets range of front-panel ALC GAIN control.
5-28	A6R2	LO	Adjusts 6.2 GHz switchpoint.
5-28	A5R2	BAND 1 HI	Adjusts 6.2 GHz switchpoint.
5-28	A6R6	HI	Adjusts 12.4 GHz switchpoint.
5-28	A5R6	BAND 3 B	Adjusts 12.4 GHz switchpoint.
5-29	A3R63	C	Offsets FREQ REF output voltage.
5-29	A3R55	B	Adjusts FREQ REF output voltage at high end.
5-30	A4R46	NO NAME	Selected for YTO/YTO Driver FM sensitivity match.

Table 5-2. Factory Selected Components

Ref. Desig.	Function	Range of Values
*A2R60	Coarse adjustment of YTM reference resistor	100 – 2000 ohms
*A2R65	Coarse adjustment of YTM reference resistor for lower end of frequency range.	500 – 25K ohms
*A2R73	Linearity Compensation	5000 ohms – open
*A2R74	Linearity Compensation	5000 ohms – open
*A2R76	Linearity Compensation	5000 ohms – open
*A2R79	Linearity Compensation	5000 ohms – open
*A3R46	Linearity Compensation	50K – 1M ohms
*A3R47	Linearity Compensation	10 – 100K ohms
*A3R48	Linearity Compensation	10 – 100K ohms
*A3R49	Linearity Compensation	50K – 1M ohms
*A3R59	Coarse Frequency Adjustment	100 – 5000 ohms
*A4R46	FM Sensitivity Adjustment	13.3 – 316 ohms
*A1R88	Level Control of RF BLANK	0-5000 ohms

*Actual value selected is recorded on RF Section casting.

Table 5-3. Adjustments By Assemblies

Assembly Changed	Adjustment Sections to be Performed
A1	5-27
A2	5-23 and 5-26
A3/A9	5-22, 5-26 and 5-29
A4	5-19 and 5-30
A5	5-20 and 5-28
A6	5-21 and 5-28
A7	No adjustment necessary
A8	No adjustment necessary
A10	5-25 and 5-27
A11	5-27
A12	5-27
AT1	No adjustment necessary
CR1	5-27
DC1	5-27

*NOTE: Assemblies A3 and A9 replaced together. Order HP Part Number 86290-60065.

5-15. ABBREVIATED RF ALIGNMENT PROCEDURE

5.16 An abbreviated RF alignment procedure is attached to the casting of the RF Section. This procedure may be used in lieu of the complete tracking and frequency adjustments in paragraph 5-23. It can be used when (1) there is a decrease in CW power, (2) power decreases when changing sweep speeds, or (3) when the PEAK control does not have enough range to optimize output power. Changes in frequency accuracy may also be corrected with this procedure. Use of this abbreviated procedure is to be limited to minor adjustments only. If the indications point to extensive trouble, see the complete adjustment procedures or refer to Section VIII for service and troubleshooting. Figure 5-1 shows the abbreviated RF alignment procedure.

5-17. LOCATION OF TEST POINTS AND ADJUSTMENTS

5-18. Each adjustment test contains one or more figures calling out appropriate test point and adjustment locations.

ADJUSTMENTS

5-19. FREQUENCY MODULATION BALANCE ADJUSTMENT

REFERENCE:

Service Sheet 4, FREQUENCY MODULATION ASSEMBLY.

Sets voltages to establish zero frequency offset.

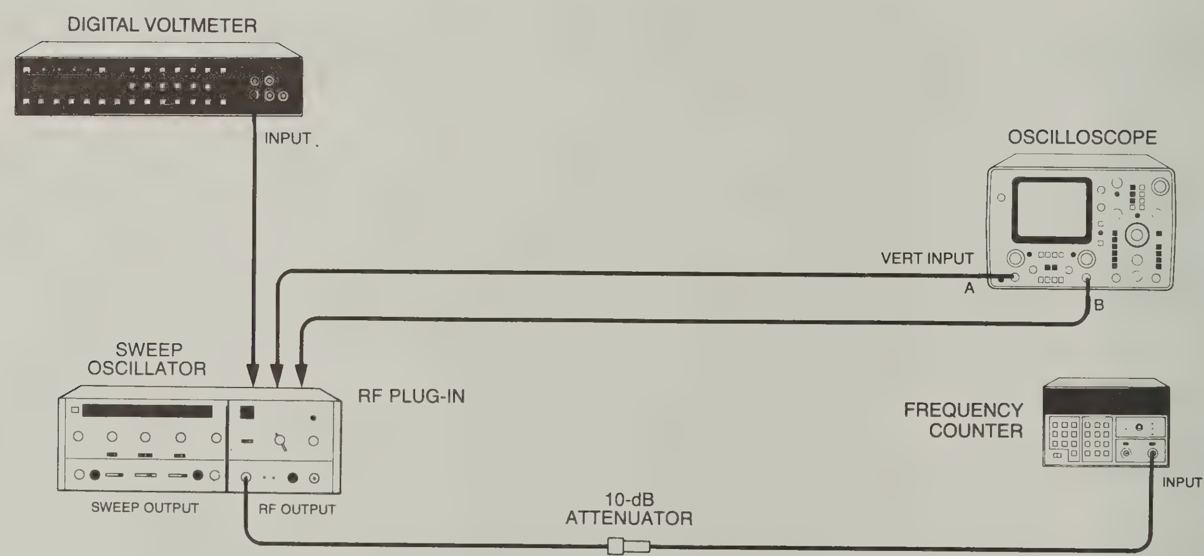


Figure 5-2. Modulation Balance Adjustments Setup

ADJUSTMENTS

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Digital Voltmeter	HP 3456A
Frequency Counter	HP 5343A
Oscilloscope	HP 1740A
10-dB Attenuator	HP 8491B, Option 010

PROCEDURE:

a. Press 8620C LINE switch to ON and select Band 4. Allow 30 minutes warm-up time.

b. Press 8620C CW pushbutton. Adjust the CW MARKER for 10.3 GHz.

c. Connect digital voltmeter to A4TP2 and connect ground to A4TP4. Adjust A4 BAL control A4R16 for digital voltmeter indication of 0.00 Vdc ±0.01 Vdc.

A4

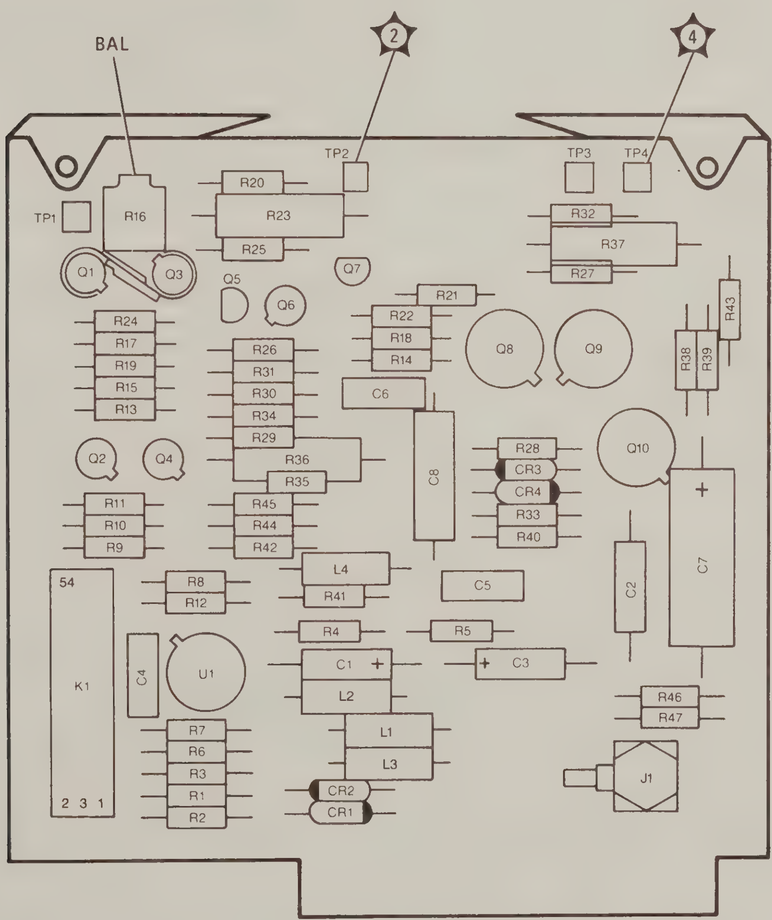


Figure 5-3. Frequency Modulation Balance Adjustment Locations

ADJUSTMENTS

5-20. SWEEP CONTROL ADJUSTMENTS

REFERENCE:

Service Sheet 5, SWEEP CONTROL ASSEMBLY.

DESCRIPTION:

Set ramp voltages to establish proper frequencies.

EQUIPMENT:

Use test setup in Figure 5-2.

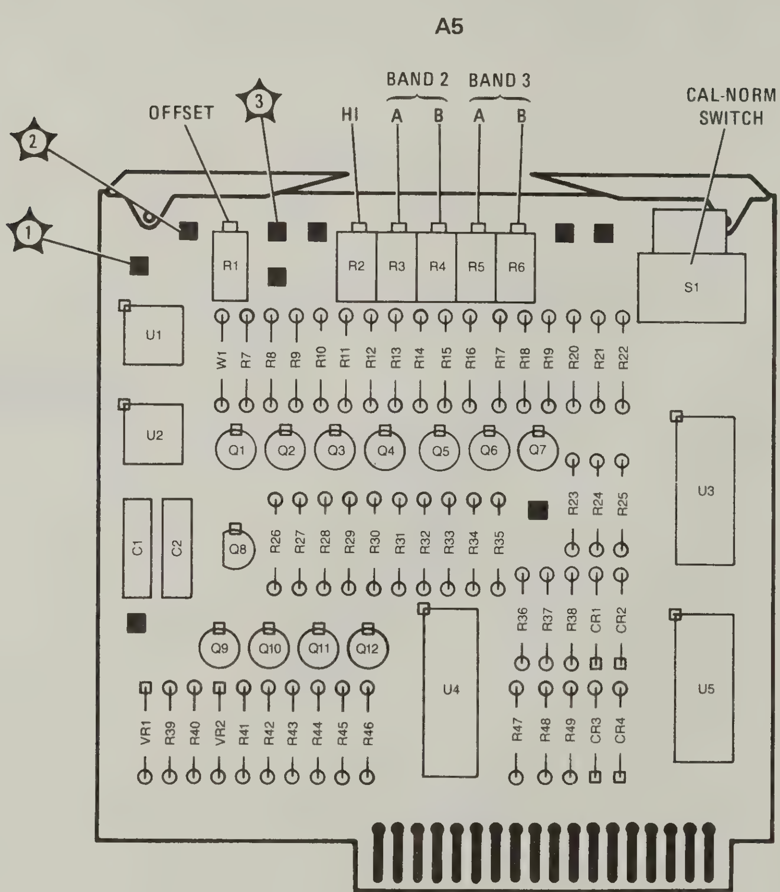


Figure 5-4. Sweep Control Adjustment Locations

PROCEDURE:

a. Select Band 1, Press CW and CW VERNIER pushbuttons. Set NORM-CAL switch A5S1, at top of A5 Sweep Control Board, to CAL (towards front panel).

ADJUSTMENTS

b. Connect digital voltmeter to A5TP1; ground lead to A5TP3 (FREQ REF GND). Adjust 8620C CW MARKER and CW VERNIER controls for digital voltmeter indication of 0.000 Vdc ±0.001 Vdc.

c. Connect digital voltmeter to A5TP2. Adjust A5 OFFSET A5R1 for 0.000 Vdc ±0.001 Vdc.

d. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for +2.530 Vdc ±0.001 Vdc.

e. Connect digital voltmeter to A5TP2. Adjust A5 Band 1 HI A5R2 for +10.000 Vdc ±0.001 Vdc.

f. Select Band 2.

g. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for 3.921 Vdc ±0.001 Vdc.

h. Connect digital voltmeter to A5TP2. Adjust A5 Band 2 B A5R4 for +3.921 Vdc ±0.001 Vdc.

i. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for 6.265 Vdc ±0.001 Vdc.

j. Connect digital voltmeter to A5TP2. Adjust A5 Band 2 A A5R3 for +10.000 Vdc ±0.001 Vdc.

k. Repeat steps g through j to minimize errors due to control interactions.

l. Select Band 3.

m. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for +10.000 Vdc ±0.001 Vdc.

n. Connect digital voltmeter to A5TP2. Adjust A5 Band 3 B A5R6 for +10.000 Vdc ±0.001 Vdc.

o. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for 6.265 Vdc ±0.001 Vdc.

p. Connect digital voltmeter to A5TP2. Adjust A5 Band 3 A A5R5 for +0.606 Vdc ±0.001 Vdc.

q. Repeat steps m through p to minimize error due to control interactions.

r. Set 86290B NORM-CAL switch A5S1 to NORM position.

s. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for 0.000 Vdc ±0.001 Vdc.

t. Connect digital voltmeter to A5TP2. Digital voltmeter should indicate 0.000 Vdc ±0.005 Vdc for 8620C set to Band 1, Band 2, or Band 3.

u. Connect digital voltmeter to A5TP1. Adjust 8620C CW MARKER and CW VERNIER controls for +10.000 Vdc ±0.001 Vdc.

v. Connect digital voltmeter to A5TP2. Digital voltmeter should indicate +10.000 Vdc ±0.005 Vdc for 8620C set to Band 1, Band 2, and Band 3.

ADJUSTMENTS

5-21. STOP SWEEP ADJUSTMENTS

REFERENCE:

Service Sheet 6, STOP SWEEP ASSEMBLY.

DESCRIPTION:

Adjust 86290B for proper sequential sweep operation.

EQUIPMENT:

Use test setup in Figure 5-2.

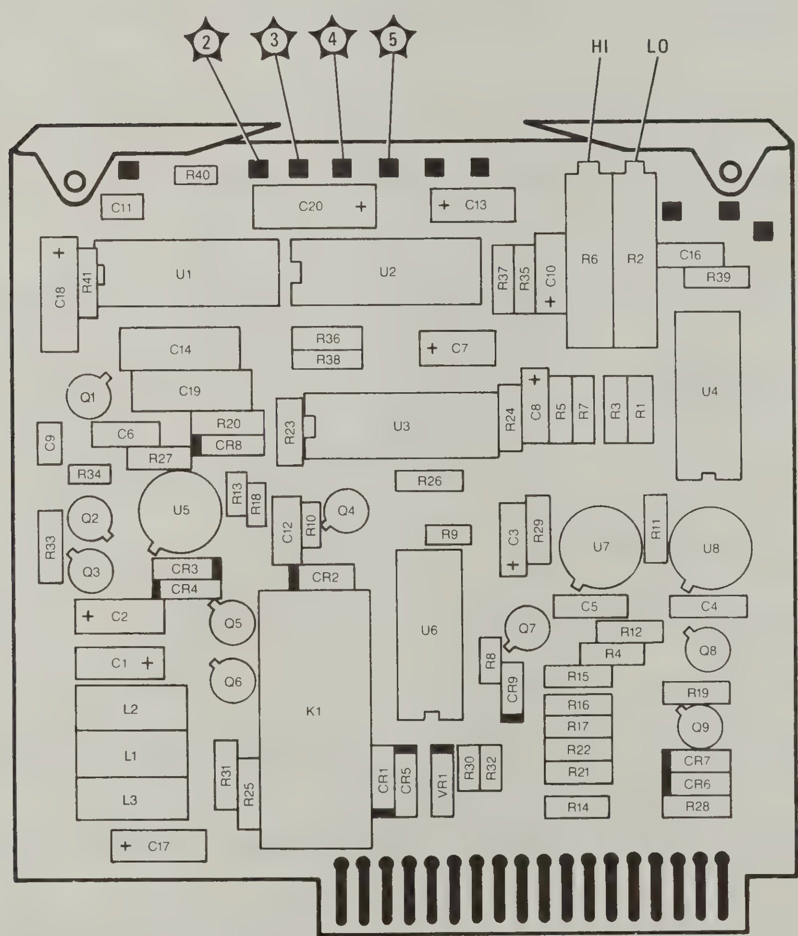


Figure 5-5. Stop Sweep Adjustment Locations

ADJUSTMENTS

PROCEDURE:

a. Set controls as follows:

8620C:

BAND	Band 4
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise

b. Press 8620C LINE pushbutton ON. Press CW pushbutton. Set CW MARKER to low end of scale.

c. Connect digital voltmeter to A6TP5; ground lead to A5TP3 (FREQ REF GND).

d. Adjust A6 LO control A6R2 for digital voltmeter indication of 2.530 Vdc ±0.002 Vdc.

e. Connect digital voltmeter to A6TP3. Adjust A6 HI control A6R6 for +6.265 Vdc ±0.002 Vdc.

f. Press 8620C FULL SWEEP pushbutton. Connect oscilloscope Channel A to A6TP2 and Channel B to A6TP4. Display should appear as shown in Figure 5-6. Time durations shown are typical; actual times measured may vary slightly.

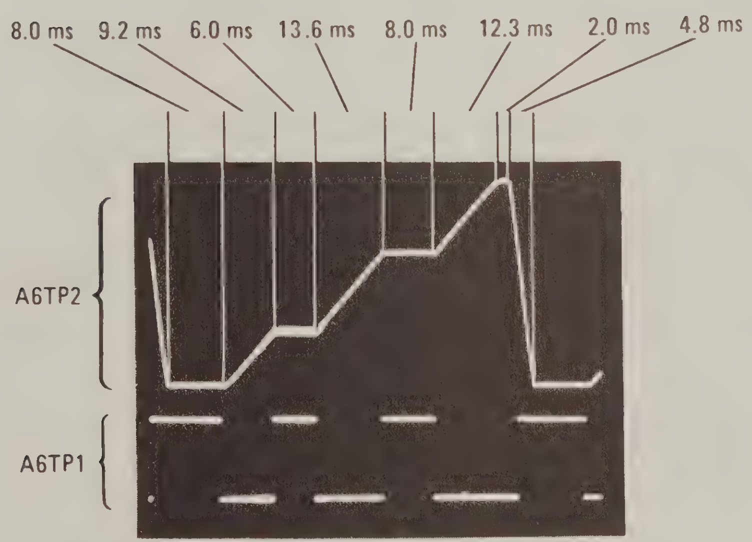


Figure 5-6. Stop Sweep Timing Waveform

ADJUSTMENTS

5-22. YTO FREQUENCY RANGE ADUSTMENTS

REFERENCE:

Service Sheet 3, YIG TUNED OSCILLATOR DRIVER ASSEMBLY.

DESCRIPTION:

Set endpoint frequencies for each band.

EQUIPMENT:

Use adjustment test setup in Figure 5-2.

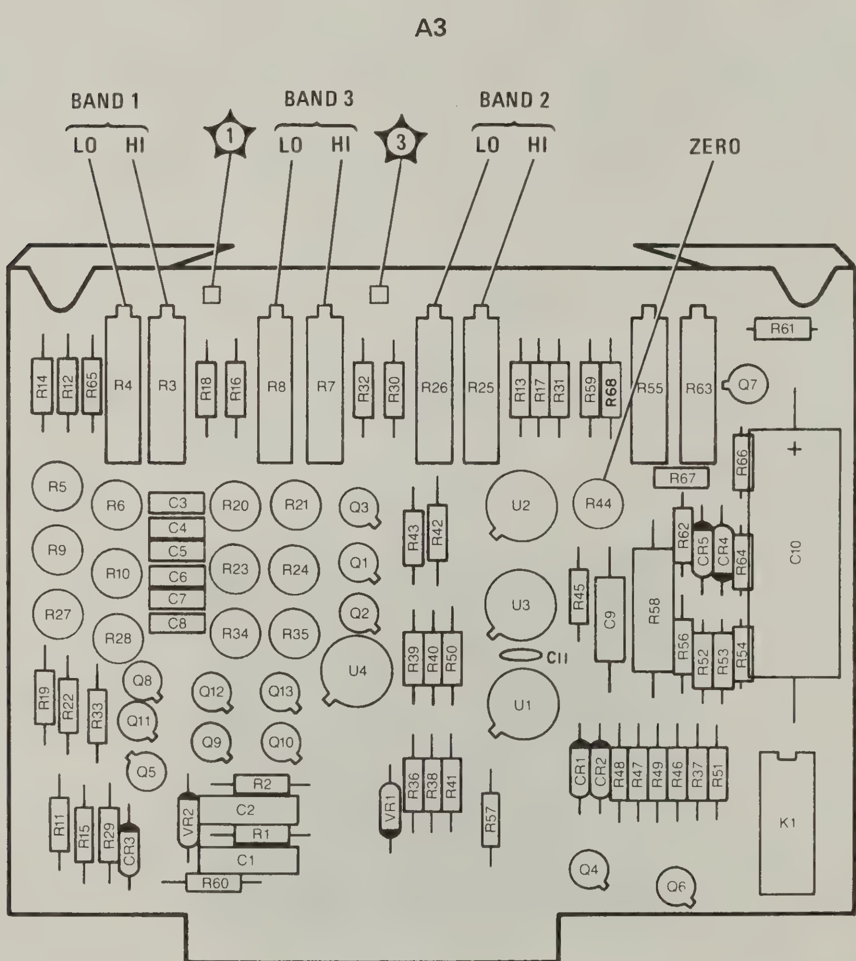


Figure 5-7. YTO Frequency Range Adjustment Locations

ADJUSTMENTS

PROCEDURE:

NOTE

If A3 YTO Drive Assembly of A3U2 Band Switch Amplifier has been replaced, perform the following adjustments. If not, go to step a and proceed with YTO Frequency Adjustments.

(1) With 8620C LINE switch OFF, remove A5 SWEEP CONTROL Assembly.

(2) Press 8620C LINE switch ON.

(3) Connect DVM HIGH lead to A3TP1 and LOW lead to A3TP3.

(4) Adjust A3 ZERO control A3R44 for DVM indication of 0.0000 Vdc −0.0001 Vdc.

(5) Press 8620C LINE switch OFF. Reinstall A2 SWEEP CONTROL Assembly.

a. Press 8620C LINE switch ON. Press CW and CW VERNIER pushbuttons. Select Band 1.

b. Connect digital voltmeter to A5TP1; ground lead to A5TP3 (FREQ REF GND).

c. Adjust CW MARKER and CW VERNIER controls for digital voltmeter indication of 0.000 Vdc ± 0.001 Vdc.

d. Adjust A3 Band 1 LO control A3R4 for a frequency counter indication of 2.000 GHz ±1 MHz.

e. Select Band 2. Adjust A3 Band 2 LO control A3R26 for 6.000 GHz ±1 MHz.

f. Select Band 3. Adjust A3 Band 3 LO control A3R26 for 12.000 GHz ±1 MHz.

g. Adjust 8620C CW MARKER and CW VERNIER controls for a digital voltmeter indication of +1.000 Vdc ± 0.001 Vdc.

h. Select Band 1. Adjust A3 Band 1 HI control A3R3 for a frequency indication of 6.200 GHz ±1 MHz.

i. Select Band 2. Adjust A3 Band 2 HI control A3R7 for 12.400 GHz ±1 MHz.

j. Select Band 3. Adjust A3 Band 3 HI control A3R25 for a frequency indication of 18.6000 GHz ±1 MHz.

k. Repeat steps c through j until adjustment errors between voltage and frequency readings are at a minimum.

ADJUSTMENTS

5-23. YTM SLOW SPEED TRACKING ADJUSTMENTS

REFERENCE:

Service Sheet 2, YIG TUNED MULTIPLER DRIVER ASSEMBLY.

DESCRIPTION:

Adjusts YTM tracking for optimum power across the band at slow sweep speeds.

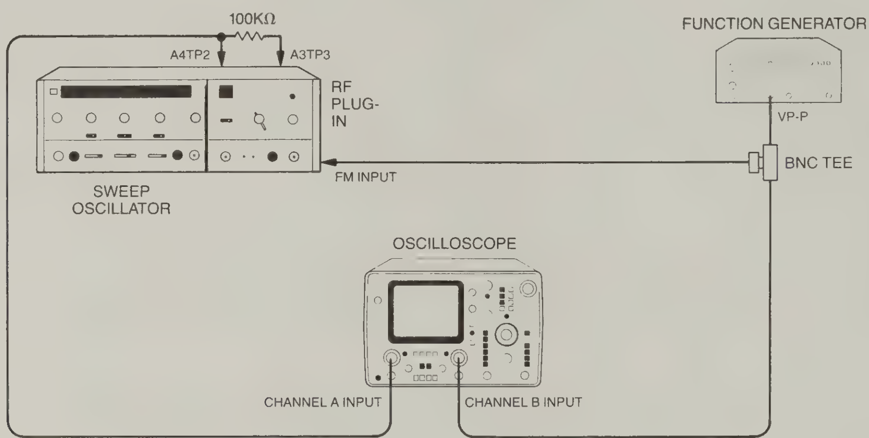


Figure 5-8. Function Generator Amplitude Adjustment Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Swept Amplitude Analyzer	HP 8755C
Display	HP 182T
Detector	HP 11664A
10-dB Attenuator	HP 8491B
Function Generator	HP 3312A
Digital Voltmeter	HP 3456A
Oscilloscope	HP 1740A
10-dB Attenuator	HP 8491B, Option 010
Extender Board	HP P/N 86290-60020
100kΩ Resistor	HP P/N 0698-7284
2kΩ Resistor	HP P/N 2100-3413
50kΩ Resistor	HP P/N 2100-3760

ADJUSTMENTS

NOTE

The following procedure assumes YTO Frequency Range Adjustments in Paragraph 5-22 have been performed.

PROCEDURE:

a. Press 8620C LINE switch OFF. Remove top cover.

b. Remove the 86290B A4 FM Driver Board, place cellophane tape on pins 8 and 9, and reinstall board. This allows the YTO to be frequency modulated without modulating the YTM.

c. Place 86290B A2 YTM Driver Board on an extender.

d. Set controls as follows:

8620C:
MODE . . . . MANUAL
86290B:
RF . . . . ON
ALC . . . . EXT
POWER LEVEL . . . . Fully clockwise
PEAK . . . . Midrange
SLOPE-OFF . . . . OFF
FM-NORM-PL (Rear Panel) . . . . FM
3312A:
RANGE Hz 1
FREQUENCY 3
FUNCTION . . . . TRIANGULAR WAVE
AMPLITUDE 10
LINE . . . . OFF
1740A:
AUTO-NORM . . . . AUTO
A vs B . . . . IN
POS-NEG . . . . NEG
AC-DC . . . . DC
DC couple Channels A and B
8755C, Channel 1:
REFERENCE LEVEL . . . . +00
REFERENCE LEVEL VERNIER . . . . OFF
dB/DIV 5
REFERENCE POSITION . . . . IN
VIDEO FILTER . . . . OUT
182T:
MAGNIFIER X1
DISPLAY . . . . EXT
EXT COUPLING . . . . DC

ADJUSTMENTS

NOTE

DO NOT change PEAK control setting during this adjustment.

NOTE

If A2 YTM Driver Assembly or A2U1 Summing Amplifier has been replaced, perform the following adjustment. If not, go to step e.

YTM Tracking Offset Adjustment

(1) Connect DVM with HIGH lead connected to A2TP1 and LOW lead to A2TP3.

(2) Remove A5 SWEEP CONTROL Assembly. Press 8620C LINE switch ON. Allow the equipment 30 minutes to warm up.

(3) Adjust A2 ZERO control A2R27 for DVM indication of 0.0000 Vdc ±0.0001 Vdc.

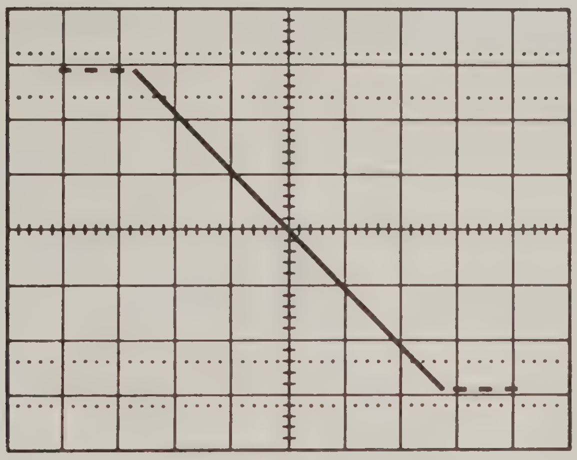
(4) Press 8620C LINE switch to OFF. Reinstall A5 SWEEP CONTROL Assembly.

e. Connect equipment as shown in Figure 5-8 (100kΩ Resistor connected from A4TP2 to A3TP3).

f. Press 8620C LINE switch and 3312A LINE switch ON. Press the 8620C CW pushbutton. Select Band 1 and adjust the CW control to 4.1 GHz. Allow the equipment 30 minutes to warm up.

g. Adjust the 3312A AMPLITUDE VERNIER so that the AMPLITUDE is just below the point of overdriving the FM amplifier. (See figure 5-9 for output waveform.) DO NOT change the 3312A AMPLITUDE CONTROL beyond this step.

ADJUSTMENTS



Solid line shows FM amplifier not being over-driven. Output waveform will extend to dotted lines when amplifier is overdriven.

Figure 5-9. FM Amplifier Output

h. Connect the equipment as shown in Figure 5-10. Be sure that the 100kΩ Resistor is still connected.

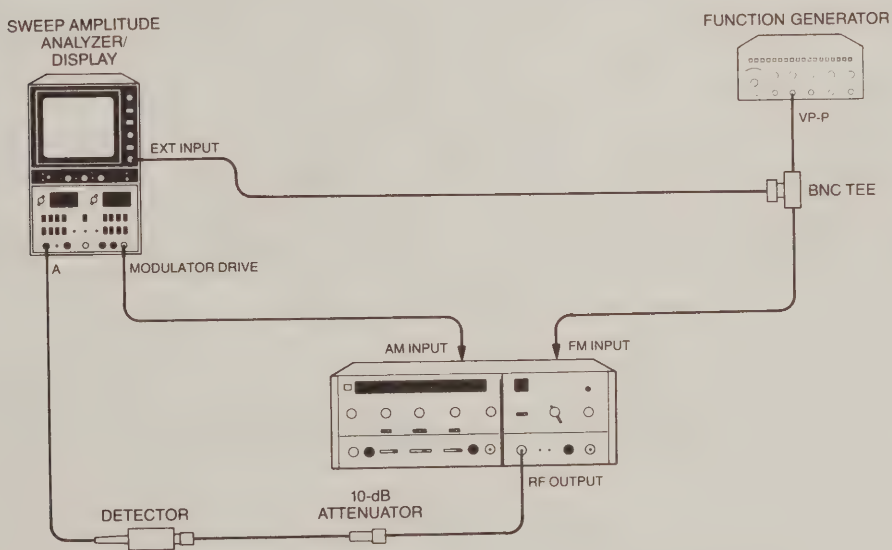


Figure 5-10. YTM Frequency Tracking Adjustment Setup

ADJUSTMENTS

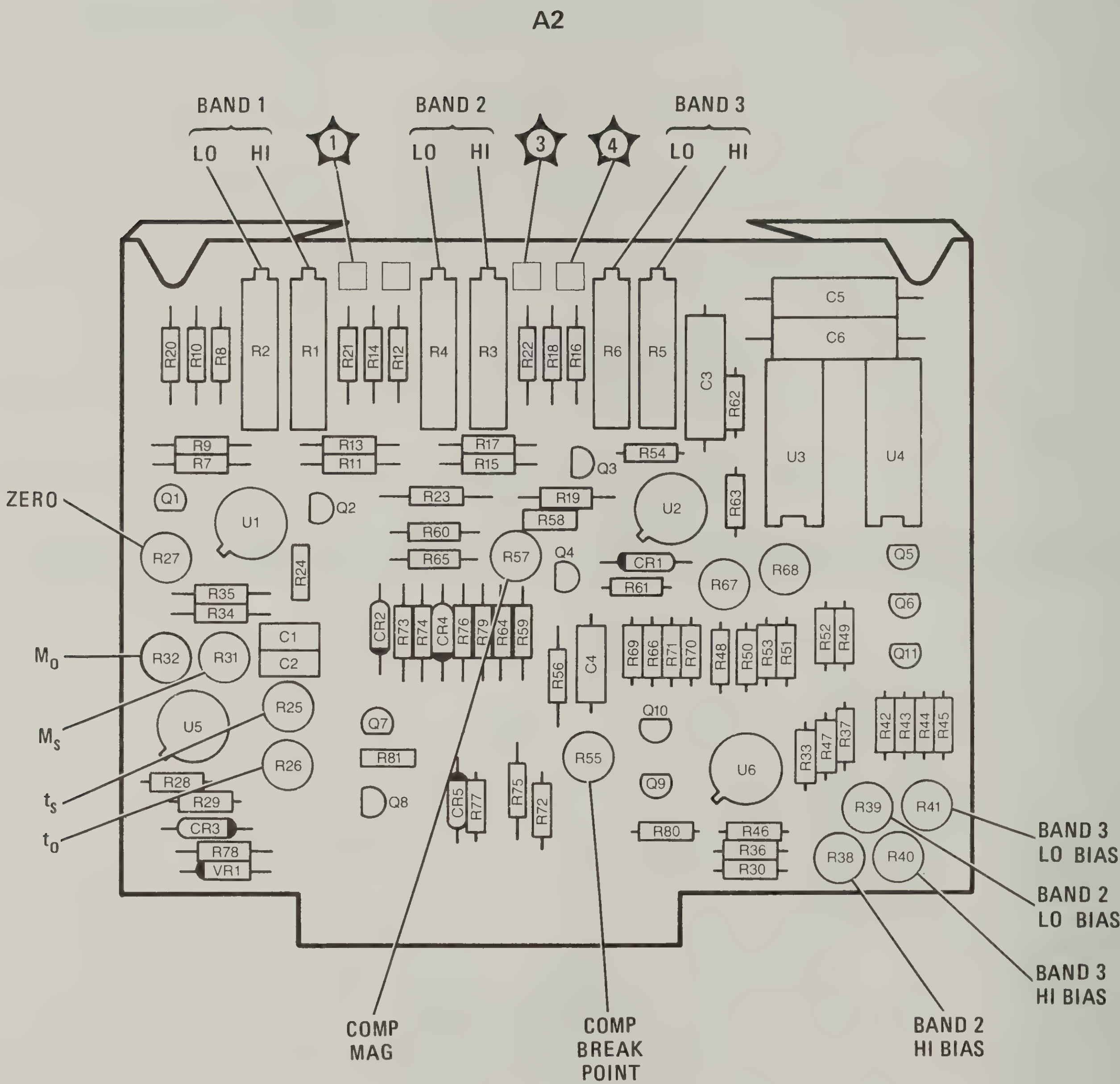


Figure 5-11. YTM Tracking Adjustment Locations

ADJUSTMENTS

i. Center Reference line on the 182T display. Adjust the 182T EXT VERNIER (horizontal) for a full 10 cm display. Press CHANNEL 1 A DISPLAY switch on the 8755C.

j. Adjust 3312A FREQUENCY until a single trace is obtained. Display should be similar to that shown in Figure 5-12.

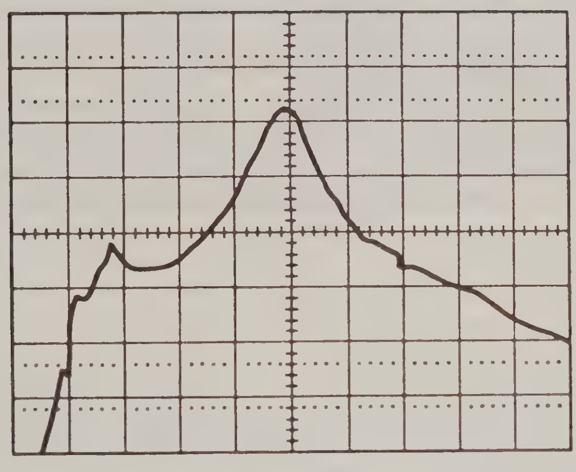


Figure 5-12. Typical Output Waveform Displays YTM Bandpass

NOTE

If this adjustment is being performed due to replacement of A12 YTM Assembly or the A2 Driver Assembly, proceed with step k. If adjustment is being performed for reasons other than A12 YTM Assembly or A2 YTM Driver Assembly replacement, go to step p.

k. Replace A2R60 with a 2kΩ pot, and A2R65 with a 50kΩ pot. Center pot adjustments. Center band tracking adjustments A2R1 through A2R6.

l. Select BAND 2 and BAND 3 alternately and adjust the 2k pot until the YTM bandpasses of BAND 2 and BAND 3 are centered. If centering the bandpasses is not possible, adjust them so that they are equidistant from the center of the display.

m. Select BAND 1. Adjust the 50k pot until the YTM bandpass is centered on the display.

n. Repeat steps l and m once to ensure the YTM bandpasses of Bands 1 through 3 are as close to the center of the display as possible.

o. Remove pots, measure resistance, and replace with fixed resistors.

ADJUSTMENTS

NOTE

During this adjustment, a power drop-out at the peak of the bandpass may occur (See Figure 5-13). This is caused by an undesired oscillation of the YTM's YIG sphere called squegging.

If squegging occurs, complete this adjustment procedure and then press CW on the 8620C. Manually sweep Bands 1 through 3 and determine the frequency at which squegging occurs. Connect a spectrum analyzer to the RF OUTPUT of the 86290B. Adjust the 86290B for + 10 dBm, and determine if squegging still occurs at the frequency it was observed. (On a spectrum analyzer, squegging will be seen as a spurious signal similar to that shown in Figure 5-14. This signal must be >50 dB below the fundamental signal.) If squegging still occurs, and exceeds specifications, the YTM may have to be replaced.

NOTE

During steps p through u, monitor the power at the peak of the YTM bandpass. Readings should stay above + 10 dBm. If power drops below + 10 dBm, and is not squegging related (see note above), perform the YTM BIAS CONTROL Adjustment procedure. If the output power is still low, troubleshoot to faulty RF component.

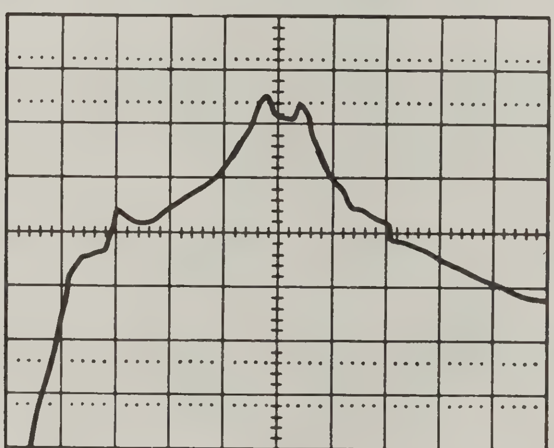
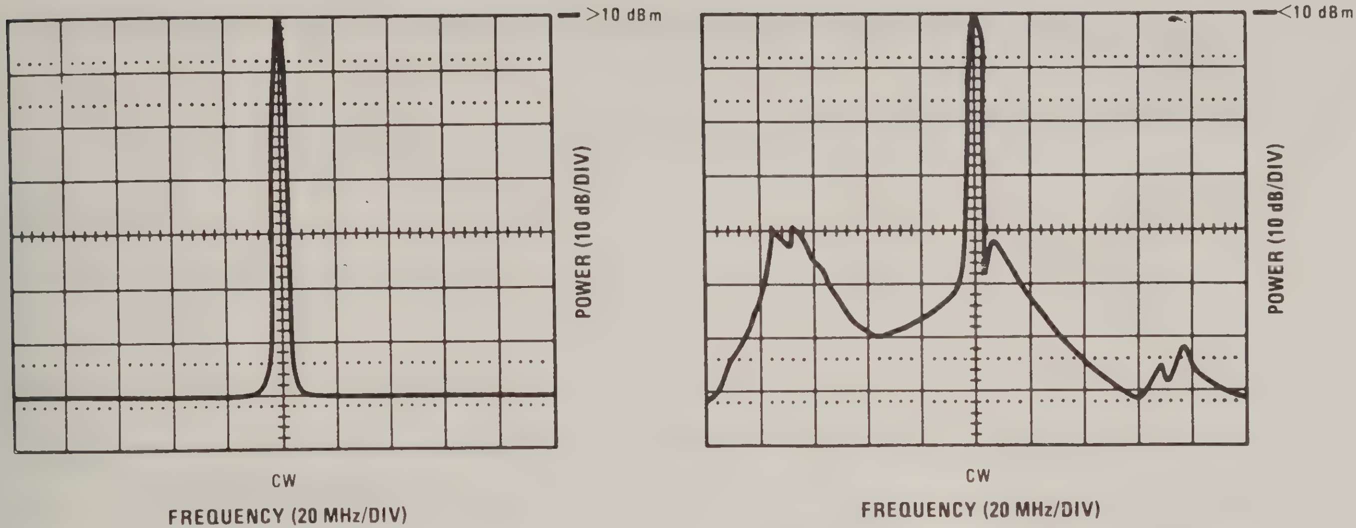


Figure 5-13. Typical Output Waveform. Displays Drop-Out at Peak of YTM Bandpass When Squegging Occurs

ADJUSTMENTS



a) Waveform when output is leveled. No squegging.

b) Waveform when squegging occurs. Power at peak is below maximum specified power because squegging causes drop in output power. Also note higher sidebands.

Figure 5-14. Typical Output Waveforms For an 86290B As Seen On a Spectrum Analyzer

p. Press FULL SWEEP on the 8620C.

q. Adjust the 8620C MANUAL sweep vernier fully counterclockwise. Select Band 1. Adjust Band 1 LO Control A2R2 for optimum tracking. (YTM bandpass centered on display at low frequency end of Band 1.)

r. Adjust the 8620C MANUAL sweep vernier fully clockwise. Adjust Band 1 HI Control A2R1 for optimum tracking at high end of Band 1.

s. Select Band 2. Using Band 2's adjustments, repeat steps q and r. (Band 2's LO Control is A2R4 and HI Control is A2R3.)

t. Select Band 3. Using Band 3's adjustments, repeat steps q and r. (Band 3's LO Control is A2R6 and HI Control is A2R5.)

u. Repeat steps p through t until the best tracking is obtained in all bands. This is done because of interaction between the adjustment pots.

ADJUSTMENTS

v. Disconnect Function Generator and remove 100kΩ resistor. Disconnect 8755C EXT INPUT and reconnect it to 8620C SWEEP OUTPUT.

w. Press 8620C FULL SWEEP pushbutton. Set controls as follows:

8620C:

MODE	AUTO
TIME-SECONDS	1 – .1
TIME-SECONDS VERNIER	MIDRANGE
TRIGGER	INT

x. Select Band 2. Adjust Band 2 LO BIAS A2R39 and Band 2 HI BIAS A2R38 for maximum power across Band 2.

y. Select Band 3. Adjust Band 3 LO BIAS A2R41 and Band 3 HI BIAS A2R40 for maximum power across Band 3.

z. Repeat steps x and y for optimum power in Band 2 and Band 3. Minimum power point should be >+10 dBm.

NOTE

Remember to remove the cellophane tape from pins 8 and 9 of the 86290B A4 board.

ADJUSTMENTS

5-24. YTM SLOW SPEED TRACKING ADJUSTMENTS (ALTERNATE PROCEDURE)

REFERENCE:

Service Sheet 2, YIG TUNED MULTIPLIER DRIVER ASSEMBLY.

DESCRIPTION:

Adjusts YTM tracking for optimum power across all bands at slow sweep speeds.

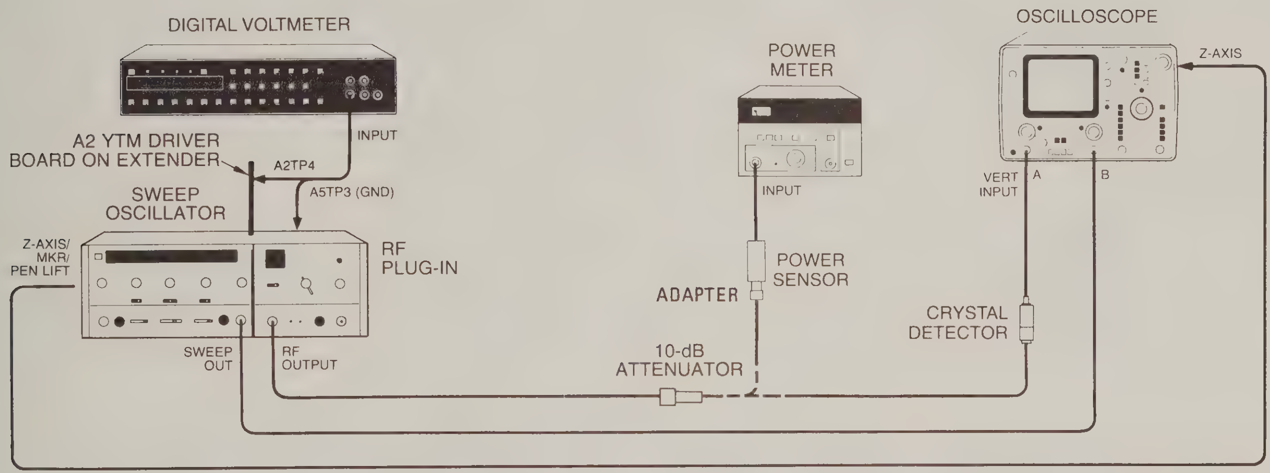


Figure 5-15. YTM Slow Speed Tracking Adjustments Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Power Meter	HP 436A
Power Sensor	HP 8485A
Digital Voltmeter	HP 3456A
Crystal Detector	HP 8470B, Option 012
Oscilloscope	HP 1740A
10-dB Attenuator	HP 8491B, Option 010
Extender Board	HP P/N 86290-60020
Adapter (APC 3.5 (f) to N (m))	HP P/N 1250-1744

ADJUSTMENTS

NOTE

The following procedure assumes YTO Frequency Range Adjustments in Paragraph 5-22 have been performed.

PROCEDURE:

a. Set controls as follows:

8620C:

BAND	Band 3
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully counterclockwise
LINE switch	OFF

86290B:

RF	ON
ALC	INT
POWER LEVEL	Fully clockwise
PEAK	Midrange
SLOPE-OFF	OFF

NOTE

DO NOT change PEAK control setting during this adjustment.

NOTE

If A2 YTM Driver Assembly or A2U1 Band Change Amplifier has been replaced, perform the following adjustment. If not, go to step b and proceed with slow speed tracking adjustments.

ADJUSTMENTS

A2

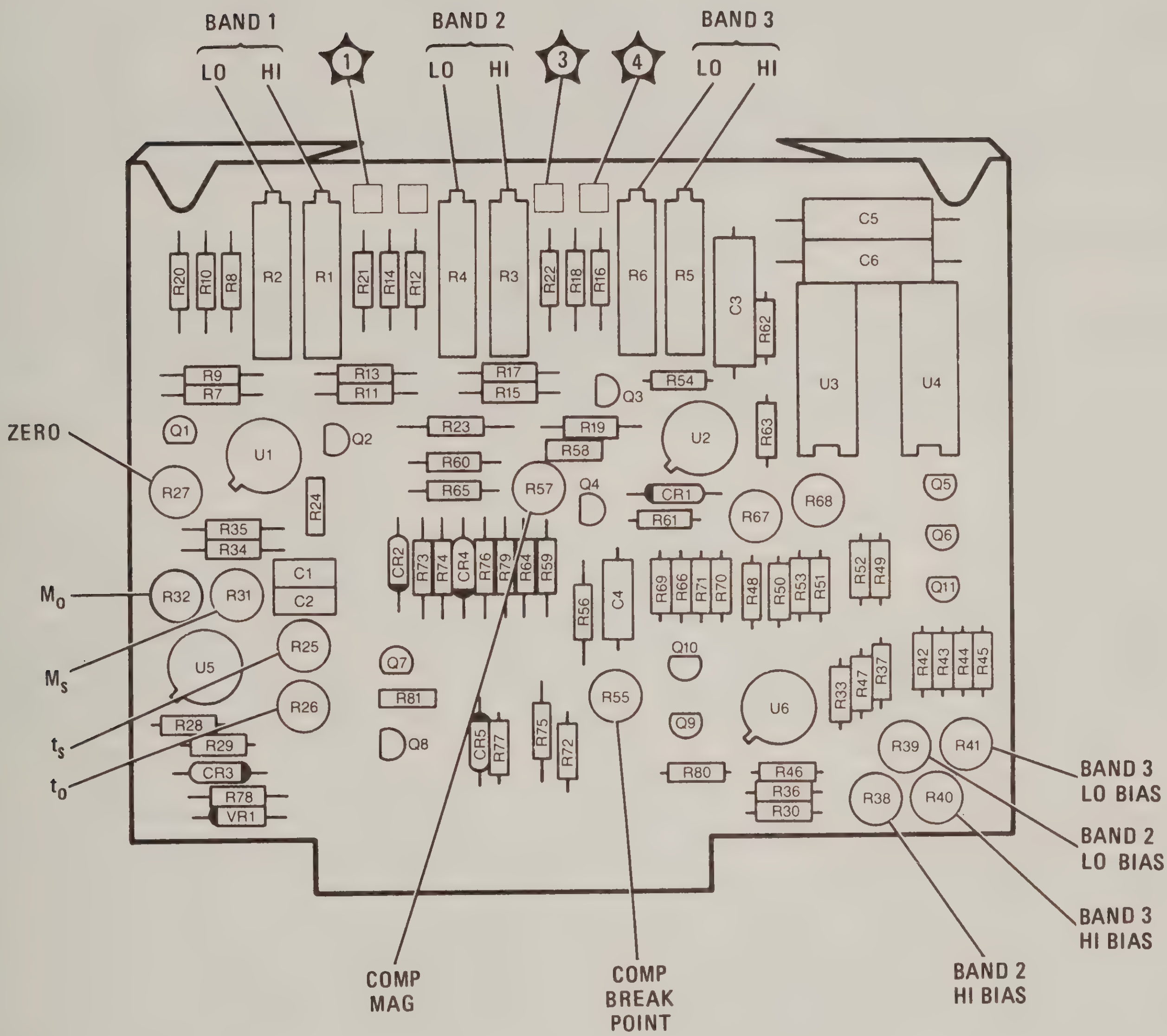


Figure 5-16. YTM Slow Speed Tracking Adjustment Locations

ADJUSTMENTS

YTM Tracking Offset Adjustment

(1) Connect DVM as shown in Figure 5-15 with HIGH lead connected to A2TP1 and LOW lead to A2TP3.

(2) Remove A5 SWEEP CONTROL Assembly. Press 8620C LINE switch ON. Select Band 1.

(3) Adjust A2 ZERO control A2R27 for DVM indication of 0.0000 Vdc ±0.0001 Vdc.

(4) Press 8620C LINE switch to OFF. Reinstall A5 SWEEP CONTROL Assembly.

b. Connect equipment as shown in Figure 5-15 with oscilloscope connected to 86290B RF OUTPUT. Install A2 YTM Driver Assembly on extender board (Figure 1-1). Set ALC Function switch A1S1 Position #3 up. Press 8620C LINE switch ON. Select Band 3.

NOTE

If this adjustment is being performed due to replacement of A12 YTM assembly and new values for A2R60 and A2R65 are not known, proceed with step c. If new values for A2R60 and A2R65 are provided (See Figure 5-1), install new values and go to step i. If adjustment is being performed for reasons other than A12 YTM Assembly replacement, go directly to step i.

c. Set 86290B A2 controls as follows:

to control	One-quarter turn clockwise
ts control	Midrange
Ms control	Fully counterclockwise
MO control	Fully counterclockwise
COMP MAG control	Fully counterclockwise
COMP BREAK POINT control	Fully counterclockwise
Band 1 LO control	Midrange
Band 1 HI control	Midrange
Band 2 LO control	Midrange
Band 2 HI control	Midrange
Band 3 LO control	Midrange
Band 3 HI control	Midrange

ADJUSTMENTS

d. Connect digital voltmeter to A2TP4; ground lead to A5TP3 (FREQ REF GND).

e. Press 8620C CW pushbutton. Adjust CW MARKER control for digital voltmeter indication of 0.0 Vdc ±0.1 Vdc (approximately 16 GHz).

f. Set 8620 MARKER switch to INTEN and press FULL SWEEP pushbutton.

g. Replace A2R60 with a zero-to-200 ohm 1% potentiometer. Adjust resistance (normal value 100 ohms) for maximum power at MARKER frequency. Measure resistance of potentiometer and replace with fixed-value resistor.

h. Select Band 1. Replace A2R65 with a zero-to-50K ohm 1% potentiometer. Adjust resistance (nominal value 25K ohms) for optimum power across band. Measure resistance of potentiometer and replace with fixed-value resistor.

i. Adjust A2 Band 1 LO control A2R2 for maximum power at low-frequency end of Band 1. Adjust A2 Band 1 HI control A2R1 for maximum power across Band 1.

j. Select Band 2. Adjust Band 2 LO control A2R4 for maximum power across Band 2. Adjust A2 Band 2 HI control A2R3 for maximum power at high-frequency end of Band 2.

k. Adjust A2 Band 2 LO Bias A2R39 and A2 Band 2 HI Bias A2R38 controls for maximum power across Band 2.

l. Repeat steps j and k.

m. Select Band 3. Adjust Band 2 LO control A2R6 for maximum power at low frequency end of Band 3. Adjust Band 3 HI control A2R5 for maximum power across Band 3.

n. Adjust A2 Band 3 LO BIAS A2R41 and A2 Band 3 HI BIAS A2R40 controls for maximum power across Band 3. Be sure to adjust out any large "holes" in power across band. Rotate front-panel PEAK control maximum clockwise then maximum counterclockwise while monitoring CRT display. If any "holes" occur in display, readjust A2R40 and A2R41 for best response over entire band over full range of PEAK control.

o. Repeat steps m and n.

p. Disconnect oscilloscope and connect power meter to 86290B RF OUTPUT.

q. Set A1S1 ALC Function switch position #3 Down.

r. Adjust 86290B POWER LEVEL and PEAK controls for maximum leveled power.

s. Set 86290C MODE switch to MANUAL. Slowly rotate MANUAL control over full range while monitoring power meter indication.

t. Minimum power point should be greater than +10 dBm.

u. Press 8620C LINE switch OFF. Reinstall A2 YTM Driver Assembly in 86290B RF Plug-In.

5-25. YTM BIAS CONTROL ADJUSTMENT

REFERENCE;

Service Sheet 9, YTM BIAS CONTROL ASSEMBLY.

DESCRIPTION:

Adjusts YTM bias control voltage for optimum performance.

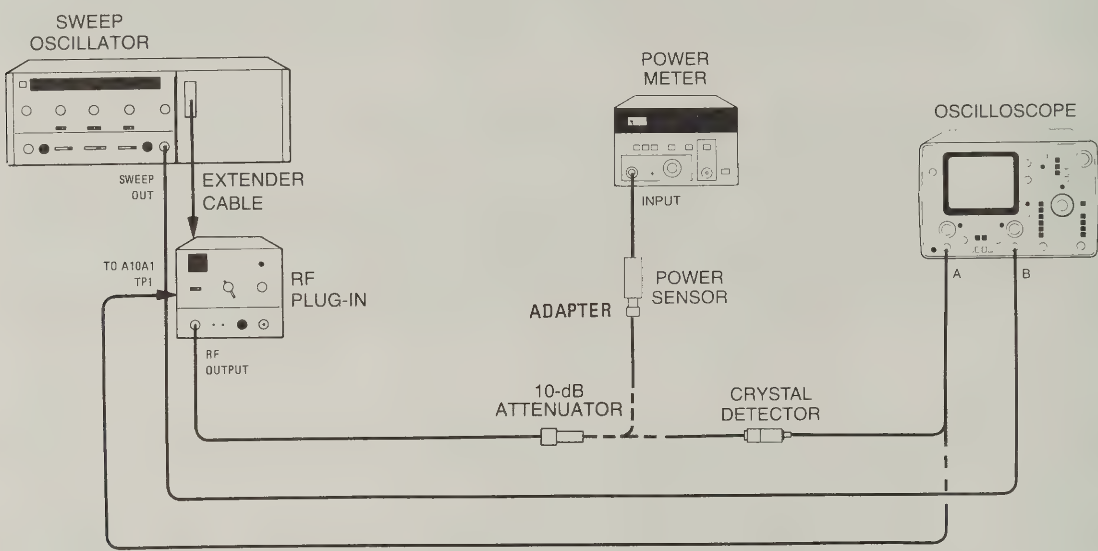


Figure 5-17. YTM Bias Control Adjustment Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Power Meter	HP 436A
Power Sensor	HP 8485A
Oscilloscope	HP 1740A
10:1 Divider Probe	HP 10004D
Crystal Detector	HP 8470B, Option 012
10-dB Attenuator	HP 8491B, Option 010
Extender Cable	HP 08620-60032
Adapter (APC 3.5(f) to N(m))	HP P/N 1250-1744

NOTE

The following adjustments should be performed only when A10, A10A1, or A11 has been repaired or replaced.

ADJUSTMENTS

PROCEDURE:

a. Press 8620C LINE SWITCH OFF. Remove 86290B RF Plug-In from 8620C mainframe (see Paragraph 2-20). Remove RF Section from 86290B (see Figure 8-42.)

b. Remove cover plate from RF section to gain access to assemblies in RF section. Reconnect gray cable W2 to A1 board and blue cable W2 to A4 board and install A1, A2, A3, and A4 boards.

c. With RF section on its side (exposed assemblies upward) and remaining part of Plug-In right side up, reconnect flexible cable W1 and reconnect cable W10 to rear of RF OUTPUT connector J1.

d. Set controls as follows:

8620C:

BAND . . . . Band 4
MODE . . . . AUTO
TRIGGER . . . . INT
TIME-SECONDS . . . . 1 – .01
TIME-SECONDS Vernier . . . . Fully clockwise

86290B:

RF . . . . ON
ALC . . . . INT
POWER-LEVEL . . . . Twelve o'clock

e. Connect equipment as shown in Figure 5-17 with oscilloscope, crystal detector, and 10-dB attenuator connected to RF OUTPUT. Press 8620C LINE switch to ON.

f. Set POWER LEVEL control for maximum specified leveled power.

g. Set PEAK control to obtain optimum flatness of signal displayed on CRT (18.6 GHz is the most critical point).

h. Disconnect crystal detector and connect power meter as shown in Figure 5-17.

i. Press 8620C CW pushbutton and set 86290B POWER LEVEL control to obtain a power meter reading of −10 dBm (0 dBm at RF OUTPUT connector).

j. Connect oscilloscope Channel A input to A10A1TP1.

k. Press 8620C MARKER SWEEP pushbutton and set OFFSET control A10A1R4 fully clockwise.

ADJUSTMENTS

A10A1

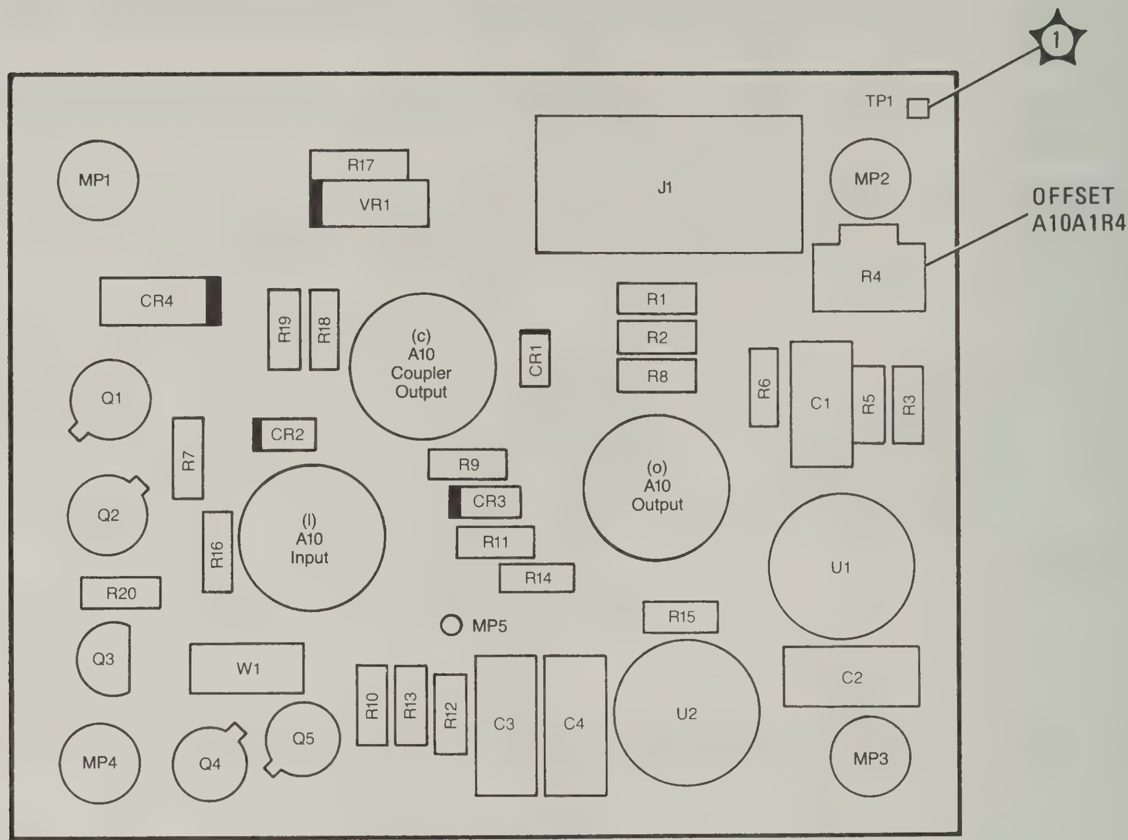


Figure 5-18. YTM Bias Control Adjustment Locations

1. Adjust OFFSET control A10A1R4 counterclockwise until CRT trace is at maximum voltage in Bands 2 and 3 portion of Band 4 sweep. Display should appear as shown in Figure 5-19.

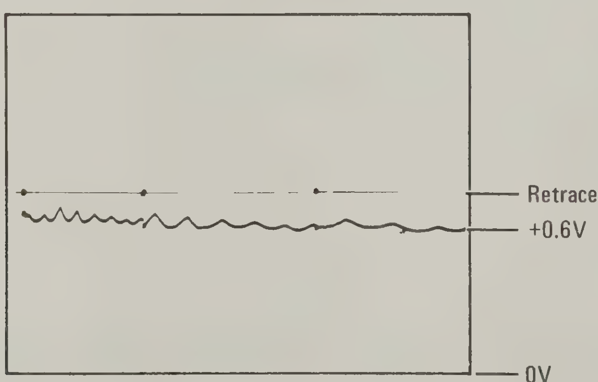


Figure 5-19. Pin Modulator Drive Voltage with Multiplier Bias Correctly Adjusted

ADJUSTMENTS

m. Set oscilloscope vertical gain to most sensitive range and adjust vertical position control to center the display.

n. Press 8620C MARKER SWEEP pushbutton. Set START MARKER pointer to 6.2 GHz and STOP MARKER to 18.6 GHz. Adjust OFFSET control A10A1TP1 back and forth very slightly to ensure that voltage at A10A1TP1 is maximum across entire display.

o. Press 8620C LINE switch OFF.

p. Remove A1, A2, A3, and A4 boards. Disconnect gray cable W2 from A1 board and blue cable W3 from A4 board.

q. Disconnect flexible cable W1 and RF cable W10 (W11 if Option 004 is installed).

r. Install RF section in 86290B (see Figure 8-42).

s. Remove extender cable and install 86290B into 8620C mainframe.

ADJUSTMENTS

5-26. YTM AND YTO DELAY COMPENSATION ADJUSTMENTS

REFERENCE:

Service Sheet 2, YTM DRIVER ASSEMBLY.
Service Sheet 3, YTO DRIVER ASSEMBLY.

DESCRIPTION:

These adjustments compensate for the delay inherent in the magnetic circuits. Slope and offset controls provide lead or lag currents for the frequency control current applied to the YTO and YTM assemblies.

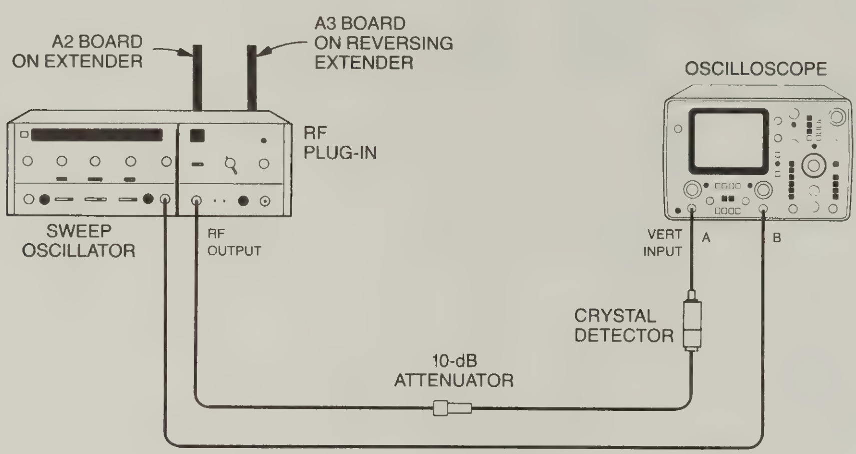


Figure 5-20. Delay Compensation Adjustments Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
Oscilloscope	HP 1740A
10-dB Attenuator	HP 8491B, Option 010
Crystal Detector	HP 8470B, Option 012
Reversing Extender Board	HP P/N 86290-60033
Extender Board	HP P/N 86290-60020

PROCEDURE:

a. Press 8620C LINE switch OFF. Connect equipment as shown in Figure 5-20. Remove A2 and A3 assemblies from 86290B. Install A2 assembly on an extender board. Install A3 on a reversing extender board.

Set 8620C controls as follows:

BAND	Band 2
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully counterclockwise

ADJUSTMENTS

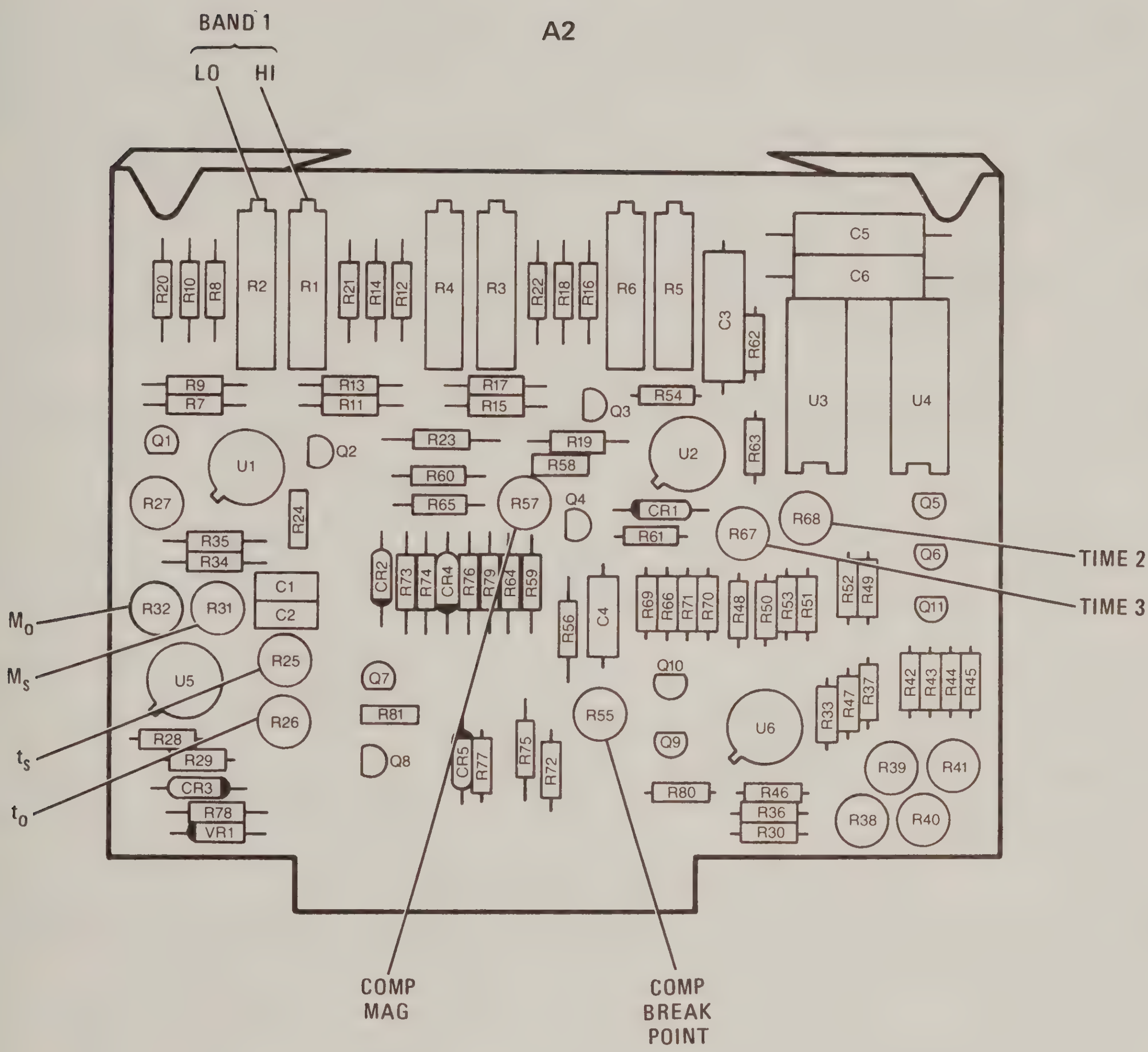


Figure 5-21. Delay Compensation Adjustment Locations (1 of 2)

ADJUSTMENTS

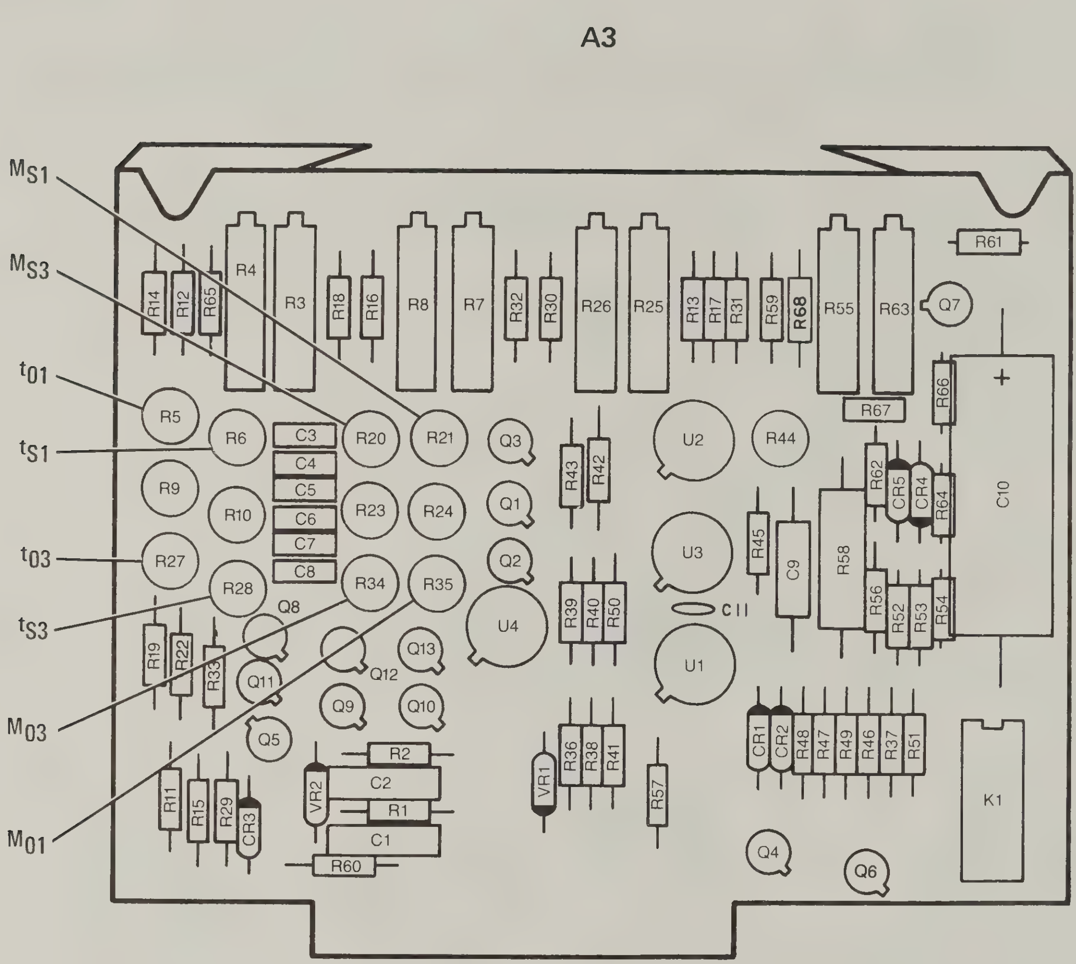


Figure 5-21. Delay Compensation Adjustment Locations (2 of 2)

ADJUSTMENTS

b. Press 8620C LINE switch ON. Adjust 86290B PEAK control for maximum output power.

c. Slowly rotate 8620C TIME-SECONDS Vernier to fully clockwise position while observing oscilloscope display. Adjust A2 Mo control A2R32 to maintain constant power level at 3 divisions from left side of display.

d. With 8620C TIME-SECONDS Vernier fully clockwise, adjust A2 Ms control A2R31 for maximum power across band.

e. Vary TIME-SECONDS Vernier while observing power variations across band. Adjust A2 Ms control to minimize variations at high end of band and A2 ts control A2R25 to minimize variations at low end of band. Do not adjust for variations in first or last one-quarter division of display.

f. Repeat steps c, d, and e to minimize power variations due to changes in sweep speed.

g. Adjust A2 to control A2R26 to minimize power variations in first and last one-quarter divisions of display.

h. Select Band 1.

i. Set 8620C TIME-SECONDS Vernier fully counterclockwise. Adjust A2 Band 1 LO A2R2 and A2 Band 1 HI A2R1 controls for maximum power across band.

j. Slowly rotate 8620C TIME-SECONDS Vernier fully clockwise while observing oscilloscope display. Adjust A3 Mo1 control A3R20 to maintain constant power level at 3 divisions from left side of display.

k. Adjust A3Ms1 control A3R21 for maximum power across band.

l. Vary TIME-SECONDS Vernier while observing power variations across band. Adjust A3Ms1 control to minimize variations at high end of band and A3 ts1 control A3R6 to minimize variations at low end of band. Do not adjust for variations in first or last one-quarter division of display.

m. Repeat steps j through l to minimize control interactions.

n. Adjust A3 to1 control A3R5 to minimize power variations in first and last one-quarter divisions of display.

o. Select Band 3. Set TIME-SECONDS Vernier fully counterclockwise. Set 86290B A2 Comp Break Point A2R55 and A2 Comp Mag A2R57 controls fully counterclockwise.

p. Adjust A2 Band 3 LO and A2 Band 3 HI controls for maximum power across band.

q. Slowly rotate 8620C TIME-SECONDS Vernier fully clockwise while observing oscilloscope display. Adjust A3 Mo3 control A3R34 to maintain constant power level at 3 divisions from left side of display.

r. Adjust A3 Ms3 control A3R35 for maximum power across band.

s. Vary TIME-SECONDS Vernier while observing power variations across band. Adjust A3 Ms3 control to minimize variations in center four divisions of display.

t. Adjust A3 ts3 control to A3R28 to minimize variations at low end of band. Disregard any high end variations.

ADJUSTMENTS

u. Repeat steps n through t to minimize control interactions. Adjust A3 to 3 control A3R27 to minimize power variations in first and last one-quarter divisions display.

v. Set 8620C TIME-SECONDS Vernier fully counterclockwise. Note display on oscilloscope. Set TIME-SECONDS Vernier fully clockwise and note point where high-frequency end rolls off.

w. Adjust A2 Comp Break Point control A2R55 clockwise to move compensation break point lower in frequency to point indicated in Figure 5-22.

x. Adjust A2 Comp Mag control A2R57 to bring bottom trace up to coincide with top trace.

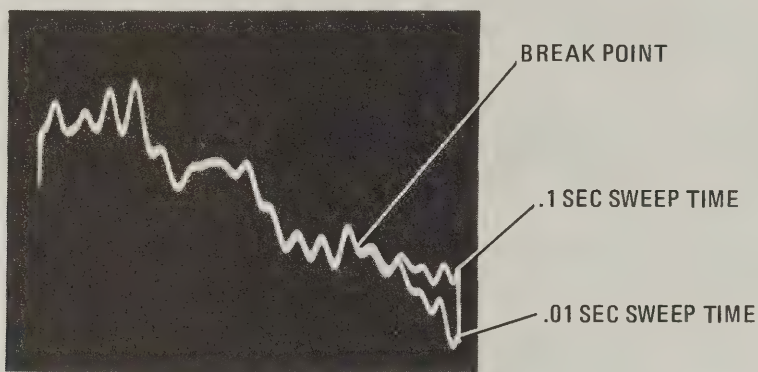


Figure 5-22. Fast Sweep Compensation Waveform

y. Select Band 4 on 8620C. While varying TIME-SECONDS Vernier over full range, adjust A2 TIME 2 control A2R68 to minimize sweep speed related power variations in the Band 2 portion of the display. Adjust A2 TIME 3 control A2R67 to minimize power variations in the Band 3 portion of the display.

z. Recheck sweep speed related power variations in all Bands. It may be necessary to readjust A2 TIME 2 and A2 TIME 3 controls so that best performance is achieved in all bands. With adjustments complete, press 8620C LINE switch to OFF and reinstall A2 and A3 assemblies in 86290B without extender boards.

ADJUSTMENTS

5-27. ALC ADJUSTMENTS

REFERENCE:

Service Sheet 1, A1 ALC ASSEMBLY

DESCRIPTION:

SYMMETRY is adjusted to set the lower limit of closed loop operation of the ALC. PIN UPPER CLAMP is adjusted for optimum flatness of oscilloscope trace. LO LEVEL CLAMP sets the minimum power level. Compensation Amplifier adjustments F1, F2, C1 and G2 are adjusted to cancel frequency dependence of the internal coupler and detector. GAIN SHAPING potentiometer is used to provide the best flatness without oscillations. UPPER POWER CLAMP is adjusted for maximum level power. GAIN PRESET adjustment is set so trace is free of oscillations over full rotation of POWER LEVEL control.

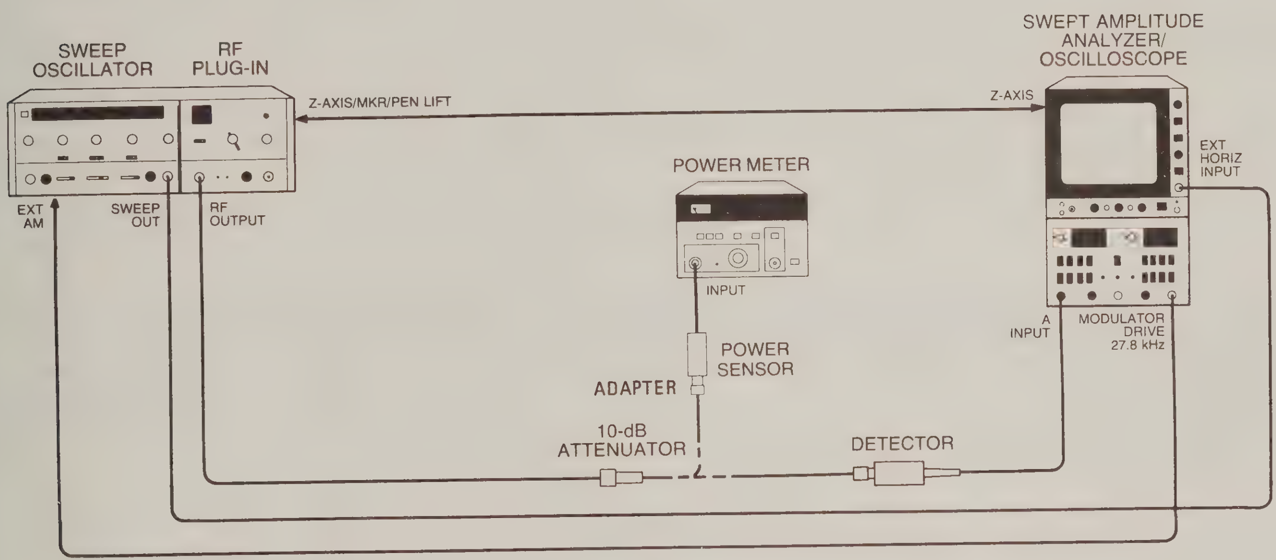


Figure 5-23. 8755C Calibration Setup

NOTE

Equipment listed is for four test setups, Figures 5-23, 5-25, 5-27 and 5-28.

ADJUSTMENTS

EQUIPMENT:

Sweep Oscillator	8620C
RF Plug-In	86290B
Oscilloscope	HP 1740A
Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664A
Power Meter	HP 432A
Power Meter	HP 436A
Thermistor Mount and 10-dB Attenuator	HP 8478B, H32
Power Sensor	HP 8485A
Crystal Detector	HP 8470B, Option 012
3-dB Attenuator	HP 8491B, Option 003
BNC Tee	HP P/N 1250-0781
Adapter (APC 3.5 (f) to N (m))	HP P/N 1250-1744

1. 8755C Calibration

NOTE

This calibration procedure is critical for this adjustment. Measurement errors due to 11664A Detector variations must be eliminated.

a. Connect equipment as shown in Figure 5-23 with power meter connected to 86290B RF OUTPUT. Do not connect 8755C MODULATOR DRIVE to 8620C EXT AM input.

NOTE

If 8755C MODULATOR DRIVE is connected to 8620C EXT AM input, there will be a 3 dB error in the power meter indication.

b. Set controls as follows:

8620C:

BAND	BAND 4

86290B:

RF ON-OFF	ON
ALC	INT
SLOPE	OFF
PEAK	Midrange

8755C:

VERNIER	ON
REFERENCE LEVEL	0
dB/DIV	.25
DISPLAY	A

ADJUSTMENTS

c. Press 8620C LINE pushbutton. Set CW MARKER pointer to 2.0 GHz.

d. Adjust 86290B POWER LEVEL control for power meter indication of 0 dBm (10 dBm minus 10-dB attenuator).

e. Disconnect power meter. Connect 8755C A input to 86290B RF OUTPUT and MODULATOR DRIVE to 8620C EXT AM input.

f. Using 8755C VERNIER control, adjust trace dot to center line of 8755C CRT and mark position with grease pencil.

g. Disconnect 8755C (including MODULATOR DRIVE). Connect power meter to 86290B RF OUTPUT.

h. Set CW MARKER pointer to 3.0 GHz.

i. Adjust 86290B POWER LEVEL control for power meter indication of 0 dBm.

j. Disconnect power meter. Connect 8755C A input to 86290B RF OUTPUT and MODULATOR DRIVE to 8620C EXT AM input.

k. Mark position of trace dot on 8755C CRT with grease pencil.

l. Repeat this process at 1 GHz intervals up to 17.0 GHz, then repeat at 17.5 GHz, 17.8 GHz, 18.1 GHz, 18.4 GHz, and 18.6 GHz.

m. After 8755C CRT has been marked across full band, connect all marks, using grease pencil, to form a calibration line across CRT, representing the frequency response of the 8755C and 11664A Detector. This calibration line will be used to set 86290B RF OUTPUT flatness (a sample calibration line is shown in Figure 5-26, WAVEFORM 3).

ADJUSTMENTS

2. Internal Coupler/Detector Compensation

a. Press 8620C LINE switch OFF. Remove 86290B from mainframe. Remove A1 ALC Assembly and disconnect gray cable W2 from A1J1.

b. Reinstall 86290B in mainframe. Reconnect W2 to A1J1 and install A1 Assembly on an extender board.

c. Preset adjustments as follows (Component Location, Figure 5-24).

A1 ALC Assembly:

PIN UPPER CLAMP	Counterclockwise
SYMMETRY	Midrange
UPPER LEVEL CLAMP	Clockwise
LO LEVEL CLAMP	Midrange
F1 and F2	Counterclockwise
G1 and G2	Counterclockwise
GAIN SHAPING	Midrange
GAIN PRESET	Midrange

ALC Function switch A1S1 (Figure 3-14):

Position 1	Down
Position 2	Down
Position 3	Up
Position 4	Up
Position 5	Down

8620C:

MODE	AUTO
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise

86290B:

POWER LEVEL	Fully counterclockwise
ALC	INT
ALC SLOPE	OFF
RF ON-OFF	ON
PEAK	Midrange

8755C:

VERNIER	OFF
REFERENCE LEVEL	−10
dB/DIV	.5
DISPLAY	A

ADJUSTMENTS

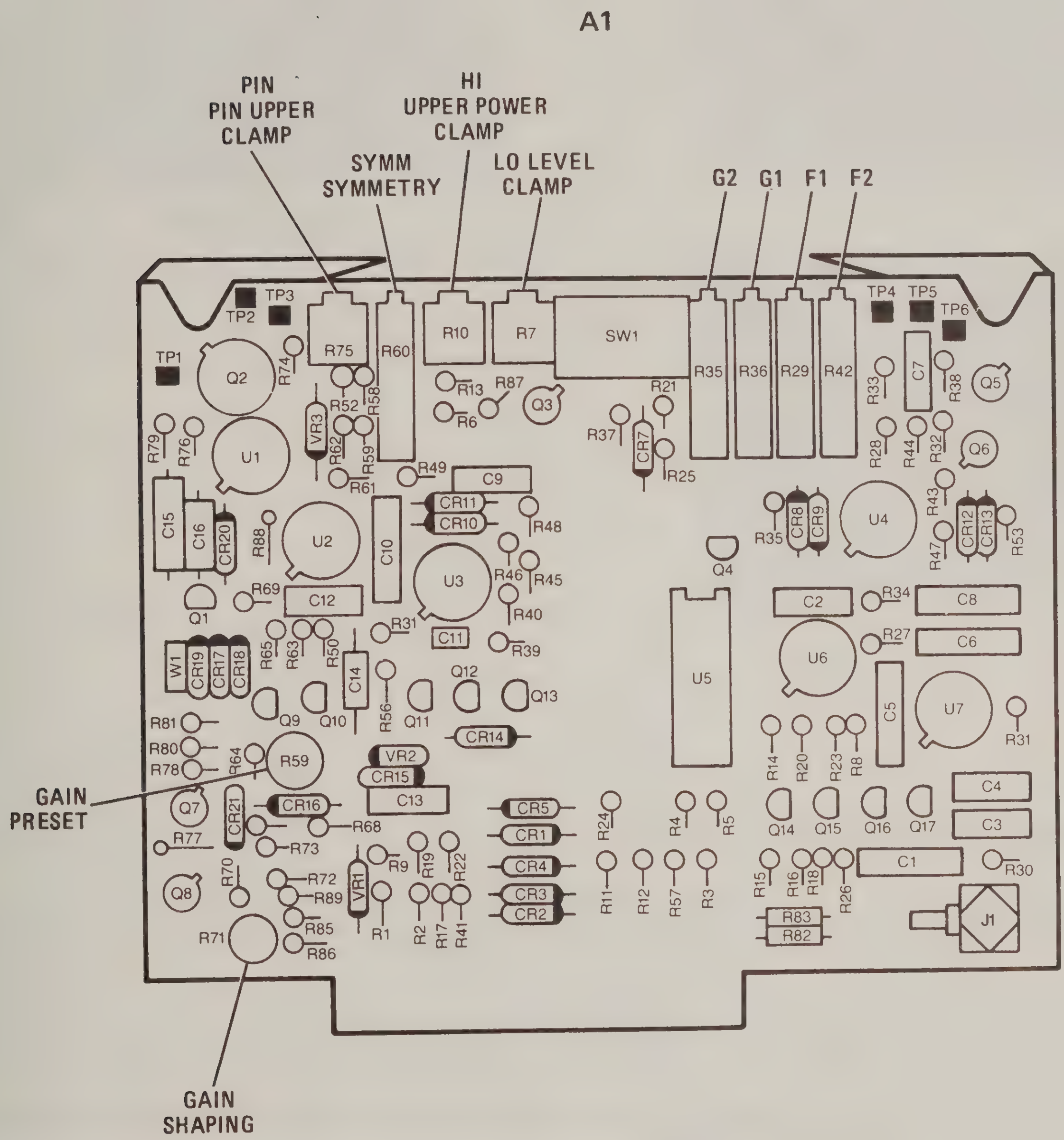


Figure 5-24. ALC Adjustment Locations

ADJUSTMENTS

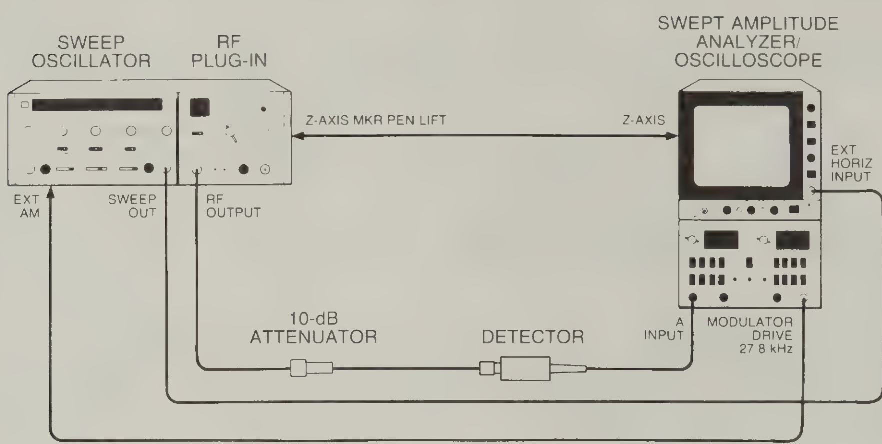


Figure 5-25. ALC Adjustment Setup

d. Connect equipment as shown in Figure 5-25.

e. Press 8620C LINE Switch ON. Press 8620C CW pushbutton, and set CW MARKER pointer to 2.0 GHz.

f. Rotate POWER LEVEL control clockwise to align trace dot with calibration line drawn in step 1, calibration. Press 8620C FULL SWEEP pushbutton. Display should be similar to either Waveform 1 or Waveform 2 of Figure 5-26.

g. Adjust F1 control A1R29 and G1 control A1R36 so the first three-quarters of the trace conforms to shape of calibration line drawn in step 1 (Figure 5-26, WAVEFORM 3).

h. Adjust F2 control A1R42 and G2 control A1R55 to conform last portion of trace to calibrated curve. (Typical adjusted response is shown as WAVEFORM 4.)

i. With compensation adjustment complete, peak-to-peak variation of display should be less than 1.6 dB (<±.8 dB peak).

ADJUSTMENTS

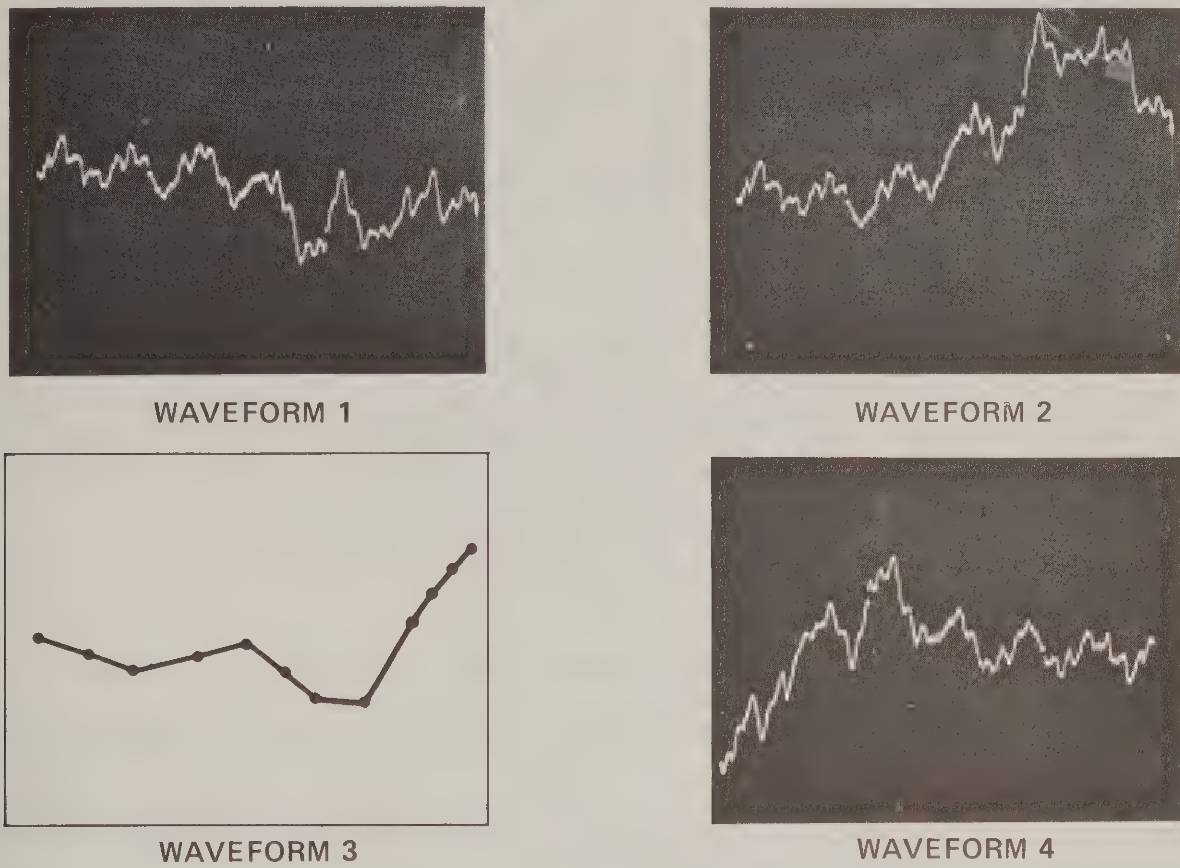


Figure 5-26. Typical Detector Compensation Adjustment Waveforms

3. Lo Level Clamp, Upper Power Clamp, and Symmetry Adjustments

a. Adjust 86290B POWER LEVEL control fully counterclockwise. Select 5 dB/DIV sensitivity on the 8755C.

b. Adjust A1R60 SYMMETRY for 0 dBm at 18.6 GHz.

c. Switch A1S1 Position #3 DOWN. Adjust A1R7 LO LEVEL CLAMP for 0 dBm at 18.6 GHz.

d. Adjust the 86290B POWER LEVEL control fully clockwise.

e. Adjust A1R1 UPPER POWER CLAMP for 11 dBm at 18.6 GHz.

f. Adjust the 86290B front panel SLOPE control for 6 dB at 2.0 GHz.

g. Adjust the 86290B POWER LEVEL control fully counterclockwise.

h. Adjust A1R60 SYMMETRY for −5 dBm at 2.0 GHz.

i. Adjust A1R7 LO LEVEL CLAMP for 3 dBm at 18.6 GHz.

j. Repeat steps h and i until optimum 5 dB slope from 2.0 to 18.6 GHz is obtained.

k. Adjust SLOPE control OFF.

ADJUSTMENTS

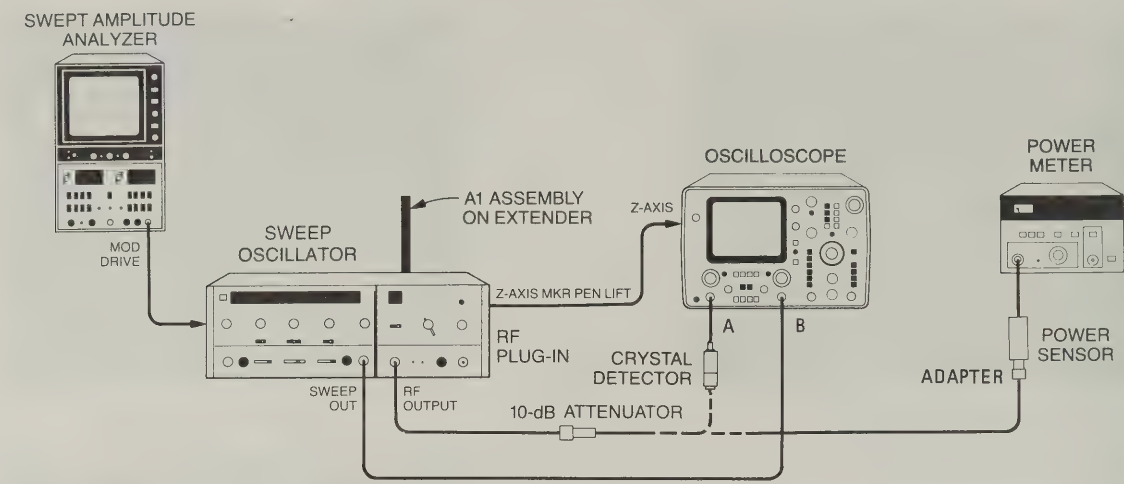


Figure 5-27. PIN Upper Clamp Adjustment Setup

4. PIN UPPER CLAMP Adjustment

a. Connect equipment as shown in Figure 5-27, with 8755C MODULATOR DRIVE disconnected.

b. Set 8620C and 86290B front panel controls as in step 2c. Press 8620C LINE switch ON and select FULL SWEEP.

c. Adjust A1R75 PIN Upper Clamp clockwise until degradation of the trace occurs (usually at low end of band), then adjust A1R75 counterclockwise until degradation just disappears. To ensure adjustment is not on threshold, adjust A1R75 two to three degrees counterclockwise.

5. Internal ALC Gain Shaping Adjustment

a. Press 8620C CW pushbutton and adjust CW MARKER for 10 GHz.

b. Connect the power meter as shown in Figure 5-27, and adjust the 86290B power level for 11 dBm.

c. Reconnect oscilloscope. Select FULL SWEEP and connect 8755C MODULATOR DRIVE.

d. Adjust A1R71 GAIN SHAPING clockwise until oscillations (other than the 27.8 KHz MODULATOR DRIVE signal) appear. Adjust A1R71 counterclockwise until oscillations just disappear.

e. Slowly rotate the 86290B POWER LEVEL control counterclockwise. If oscillations occur, adjust A1R71 counterclockwise until oscillations just disappear.

f. Repeat step e until 86290B power level control is fully counterclockwise and no oscillations occur.

ADJUSTMENTS

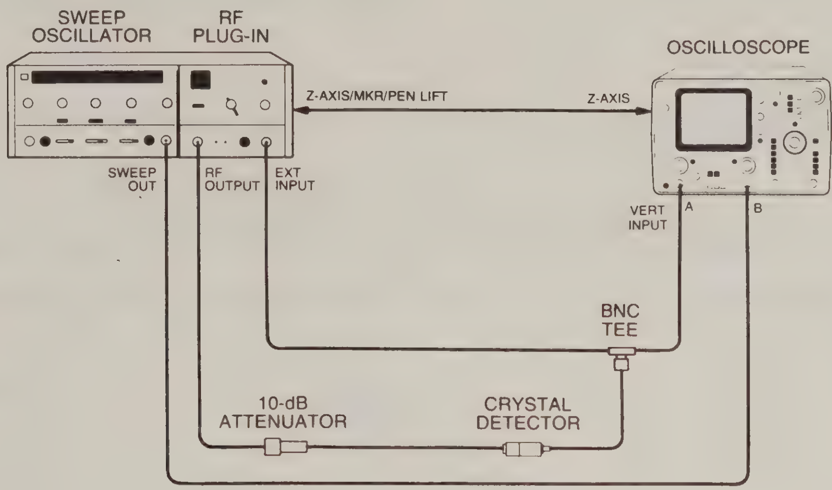


Figure 5-28. GAIN PRESET Adjustment Setup

6. GAIN PRESET Adjustment

a. Connect equipment as shown in Figure 5-27.

b. Select EXT ALC on the 86290B and rotate ALC GAIN control fully counterclockwise, then rotate clockwise 30°. Rotate POWER LEVEL control fully clockwise.

c. Select 0.2 VOLTS/DIV sensitivity on oscilloscope. Set oscilloscope input switch to GND, set trace to top graticule line, then return input switch to DC.

d. Rotate AIR59 GAIN PRESET control fully counterclockwise.

e. Rotate POWER LEVEL control slowly counterclockwise and look for oscillations on oscilloscope display.

f. If oscillations occur, adjust GAIN PRESET clockwise until oscillations just disappear.

g. Rotate POWER LEVEL control slowly through full range. If oscillations occur, continue to adjust GAIN PRESET counterclockwise to remove all oscillations over full range of POWER LEVEL control.

ADJUSTMENTS

7. Power Meter Leveling Check

a. Connect equipment as shown in Figure 5-29.

b. Ensure that power meter indication is level with +0.15 dB, and without oscillations, over full range of POWER LEVEL control. Check at CW frequencies of 6 GHz, 12 GHz, and 18 GHz.

c. If oscillations occur, adjust A1R59 GAIN PRESET control clockwise to eliminate them.

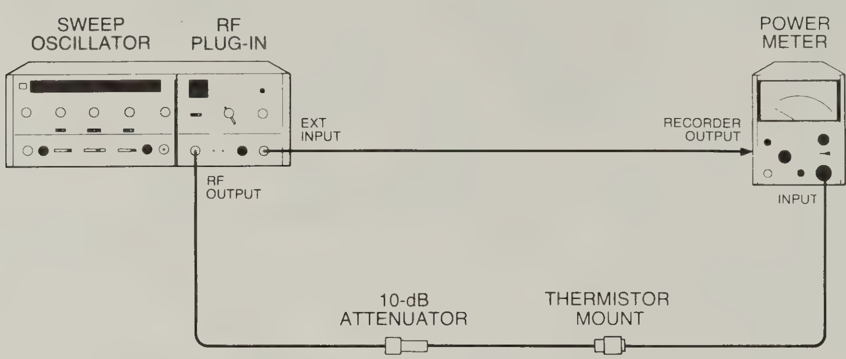


Figure 5-29. Power Meter Leveling Setup

ADJUSTMENTS

5-28. BAND SWITCH OVERLAP ADJUSTMENTS

REFERENCE

Service Sheet 5, SWEEP CONTROL ASSEMBLY and Service Sheet 6, STOP SWEEP ASSEMBLY.

DESCRIPTION:

Adjust appropriate ends of Bands 1 through 3 for frequency accuracy to ensure smooth switchpoint transitions in Sequential Band 4.

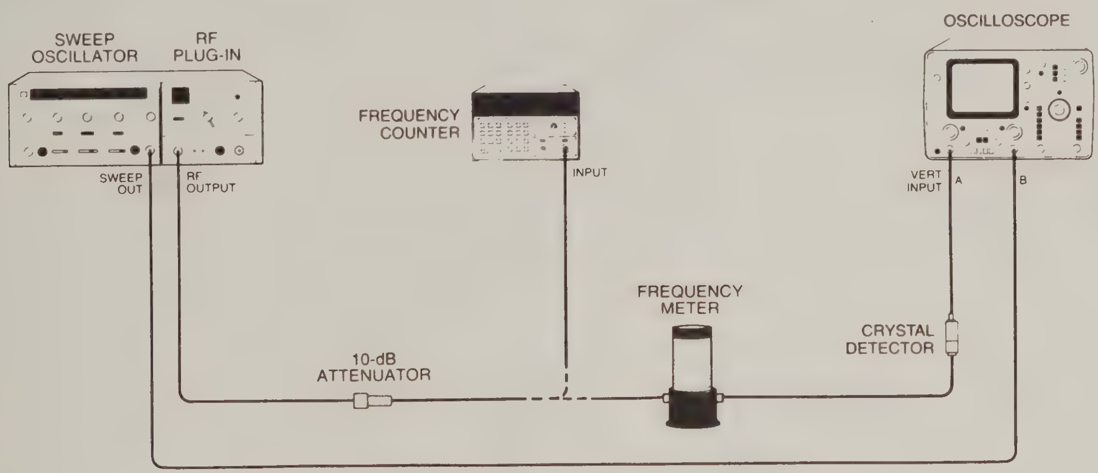


Figure 5-30. Band Switch Overlap Adjustments Setup

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B
10-dB Attenuator	HP 8491B, Option 010
Crystal Detector	HP 8470B, Option 012
Oscilloscope	HP 1740A
Frequency Meter	HP 537A
Frequency Counter	HP 5343A

PROCEDURE:

a. Set controls as follows:

8620C:

BAND	Band 4
TIME-SECONDS	.1 – .01
TIME-SECONDS Vernier	Fully clockwise

86290B:

POWER LEVEL	Fully clockwise

b. Connect equipment as shown in Figure 5-30 with frequency counter connected to 86290B RF OUTPUT. Press 8620C LINE switch ON. Press CW and CW VERNIER pushbuttons. Adjust CW MARKER and CW VERNIER controls for frequency counter indication of 6.200 GHz.

c. Connect oscilloscope and frequency meter to 86290B RF OUTPUT. Center trace dot on oscilloscope.

ADJUSTMENTS

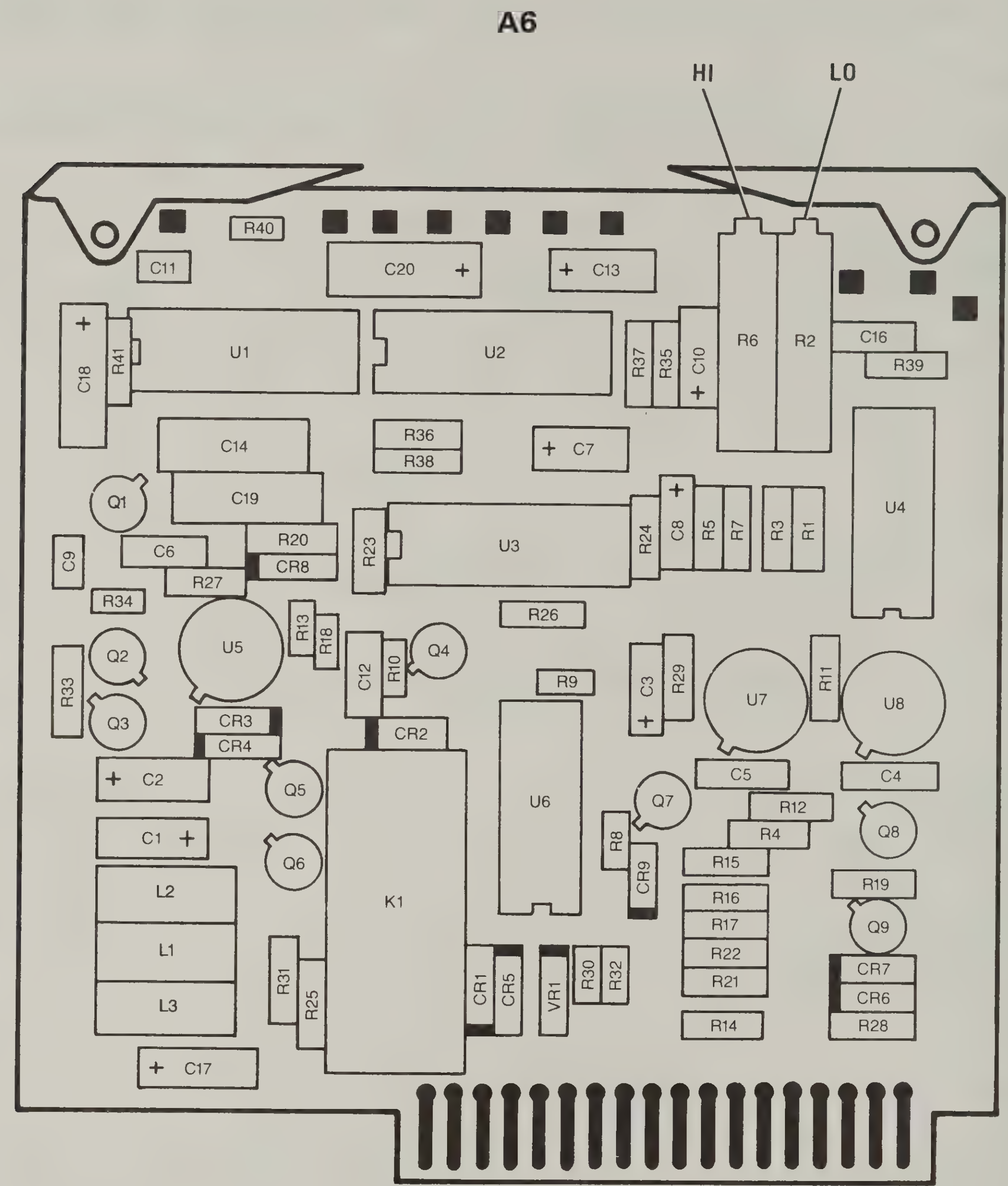


Figure 5-31. Band Switch Overlap Adjustment Locations (1 of 2)

ADJUSTMENTS

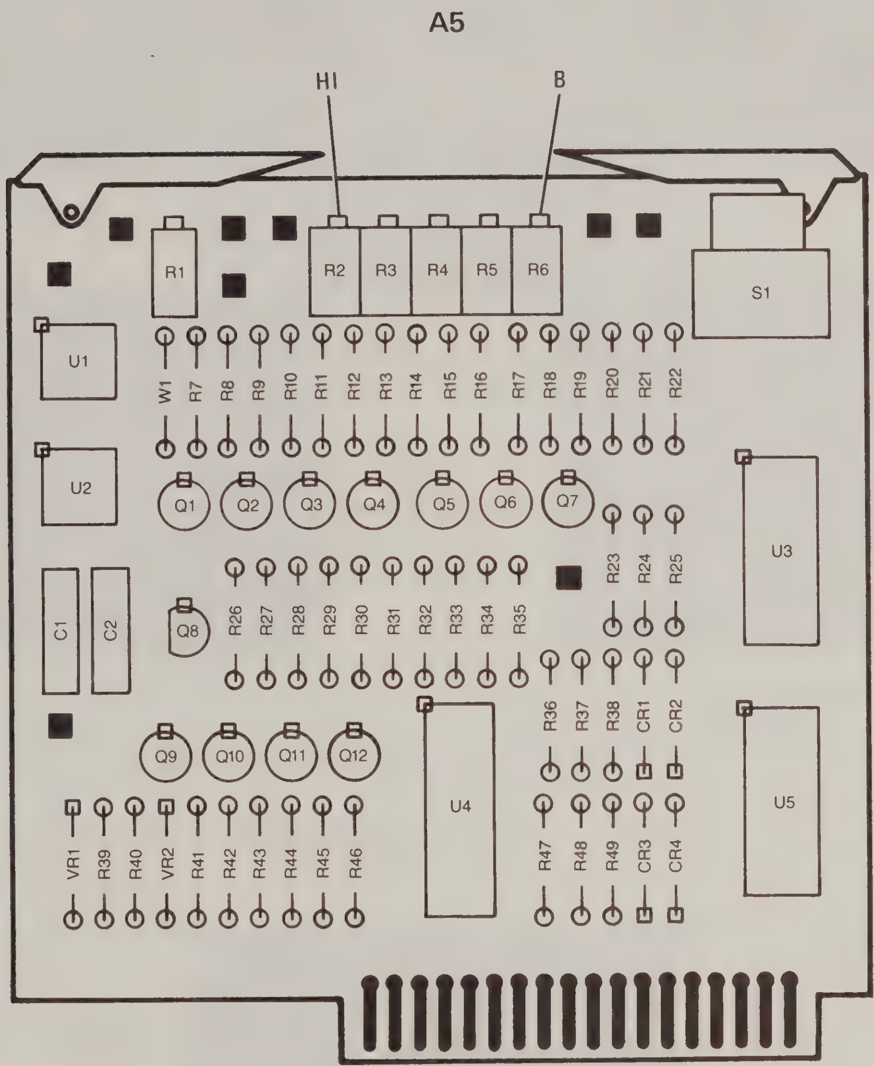


Figure 5-31. Band Switch Overlap Adjustment Locations (2 of 2)

ADJUSTMENTS

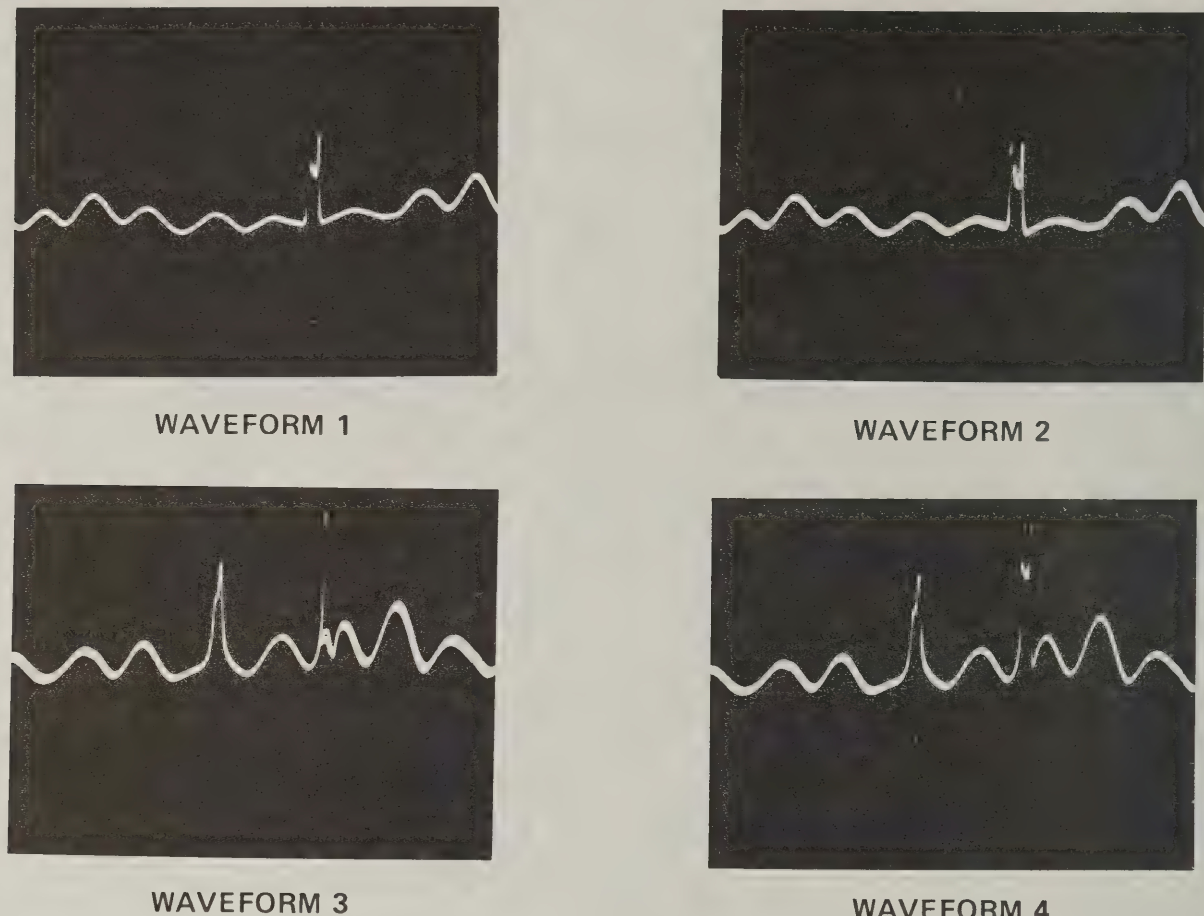


Figure 5-32. Band Switch Overlap Adjustments Waveforms

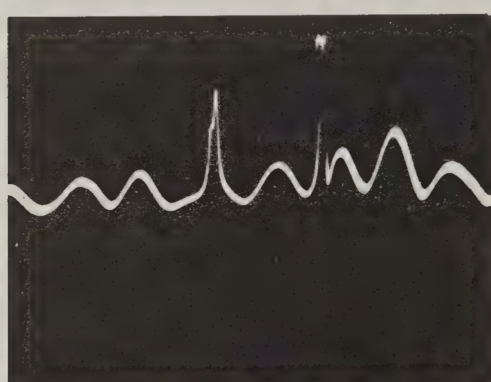


Figure 5-33. Typical Small Overlap Display

ADJUSTMENTS

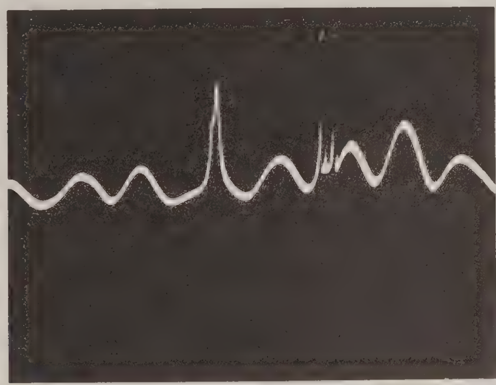


Figure 5-34. Typical Large Overlap Display

d. Adjust frequency meter around 6.2 GHz to peak trace dot. Press 8620C FULL SWEEP pushbutton.

e. Adjust A6 LO control A6R2 so that display appears as shown in Figure 5-32, Waveform 1.

f. Adjust A5 BAND 1 HI control A5R2 so that display appears as shown in Figure 5-32, Waveform 2.

g. Connect frequency counter to 86290B RF OUTPUT. Press 8620C CW and CW VERNIER pushbuttons.

h. Adjust CW MARKER control for frequency counter indication slightly less than 6.200 GHz. Slowly rotate CW VERNIER control to increase frequency while monitoring frequency counter. Note highest frequency before switchpoint occurs and also frequency just after switchpoint occurs.

i. Frequency indication just before switchpoint occurs should be higher than frequency just after switchpoint by 25 MHz ±20 MHz. This indicates an overlap of Band 1 and Band 2.

j. If condition of step i is not met, reconnect oscillscope and repeat steps e and f adjusting for more or less overlap as required (Figures 5-33 and 5-34).

k. With frequency counter connected to 86290B RF OUTPUT, adjust CW MARKER and CW VERNIER controls for a frequency counter indication of 12.400 GHz.

l. Connect oscilloscope to 86290B RF OUTPUT. Center trace dot on oscilloscope.

m. Adjust frequency meter around 12.4 GHz to peak trace dot. Press 8620C FULL SWEEP pushbutton.

n. Adjust A6 HI control A6R6 so that display appears as shown in Figure 5-32, Waveform 3.

o. Adjust BAND 3 B control A5R6 so that display appears as shown in Figure 5-32, Waveform 4. Because the A6 HI and A5 BAND 3 B controls interact, some repetition of adjustments in step n and o might be necessary.

ADJUSTMENTS

p. Connect frequency counter to 86290B RF OUTPUT. Press CW and CW VERNIER pushbuttons.

q. Adjust CW MARKER control for frequency counter indication slightly less than 12.400 GHz. Slowly rotate CW VERNIER control to increase frequency while monitoring frequency counter. Note highest frequency just before switchpoint occurs and also frequency just after switchpoint occurs.

r. Frequency just before switchpoint should be higher than just after switchpoint by 25 MHz ±20 MHz. This indicates an overlap of Band 2 and Band 3.

s. If condition of step r is not met, reconnect oscilloscope and repeat steps n and o for more or less overlap as required (Figures 5-33 and 5-34).

5-29. FREQUENCY REFERENCE CALIBRATION ADJUSTMENT

REFERENCE:

Service Sheet 3, YIG TUNED OSCILLATOR DRIVER ASSEMBLY.

EQUIPMENT:

Use test setup in Figure 5-2.

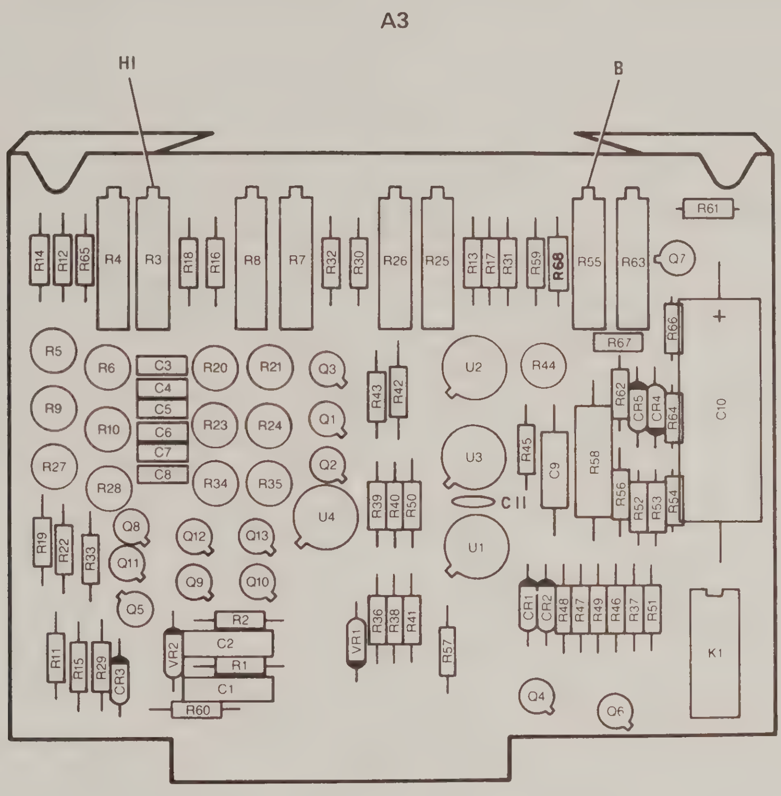


Figure 5-35. Frequency Reference Calibration Adjustment Locations

PROCEDURE:

a. Select Band 4 and press CW pushbutton.

b. Adjust CW MARKER control for frequency counter indication of 4.000 GHz ±0.001 GHz.

c. Connect digital voltmeter to 86290B FREQ REF connector J5 (rear panel).

d. Adjust A3 C control A3R63 for digital voltmeter indication of 4.000 Vdc ±0.001 Vdc.

e. Adjust CW MARKER control for frequency indication of 12.00 GHz −0.001 GHz.

f. Adjust A3 B control A3R55 for 12.000 Vdc ±0.001 Vdc.

g. Repeat steps b through f until no interaction is apparent.

ADJUSTMENTS

5-30. FREQUENCY MODULATION SENSITIVITY ADJUSTMENT

REFERENCE:

Service Sheet 4, FREQUENCY MODULATION ASSEMBLY

DESCRIPTION:

Set output of FM DRIVER circuit for proper match to YIG-TUNED OSCILLATOR sensitivity. Must be performed whenever either A4 FM ASSEMBLY or A9 YIG-TUNED OSCILLATOR is replaced.

EQUIPMENT:

Test equipment not required.

A4

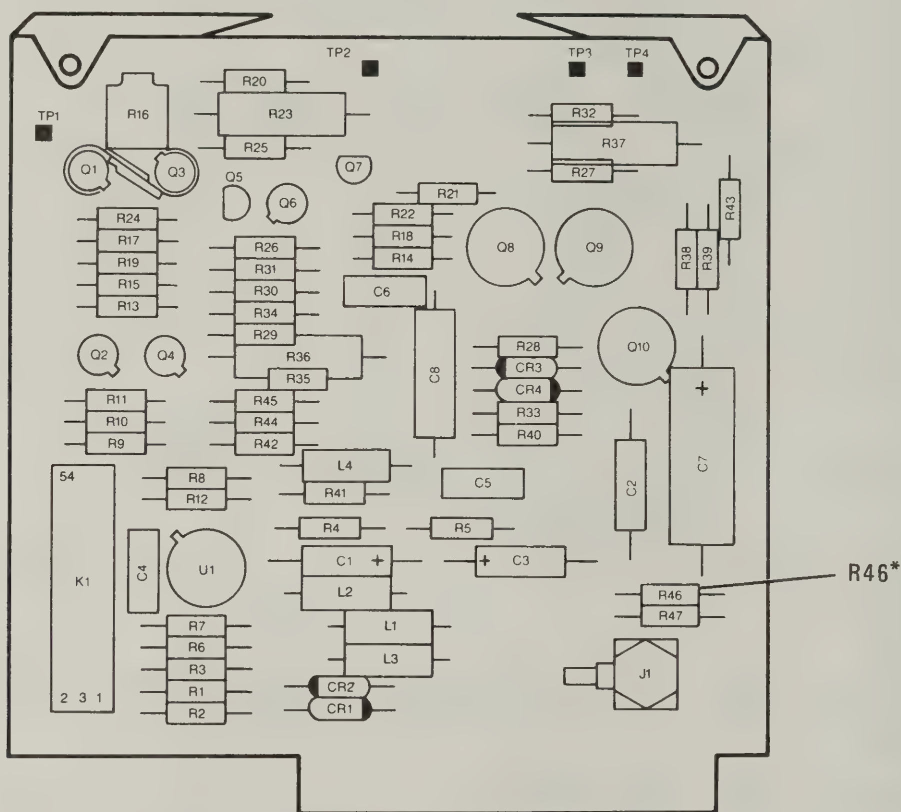


Figure 5-36. Frequency Modulation Sensitivity Adjustment Locations

PROCEDURE:

a. Note FM coil sensitivity stamped on label on YIG-TUNED OSCILLATOR.

b. Refer to Table 5-4 to determine value of A4R46* using FM coil sensitivity noted in step a.

c. Install resistor selected in step b. Refer to Figure 8-21 for component location.

d. To verify proper FM operaton, refer to paragraph 4-14, EXTERNAL FREQUENCY MODULATION TEST.

ADJUSTMENTS

Table 5-4. Resistor A4R46 Selection Guide*

Sensitivity kHz/mA	Value for A4R46 in Ohms
150-175	13.3
175-200	21.5
200-225	31.6
225-250	51.1
250-275	100
275-300	316

*Denotes factory selected component.

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains names and addresses that correspond to the manufacturer's code numbers. Figures 6-1 through 6-6 provide parts identification information.

6-3. ABBREVIATIONS

6-4. Table 6-1 lists abbreviations used in the parts list, schematics, and throughout the manual. The abbreviations in the parts list are always in capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lowercase and uppercase letters.

6-5. REPLACEABLE PARTS LIST

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numeric order by reference designation.

c. Miscellaneous parts.

d. Illustrated parts breakdown, if appropriate.

6-7. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. The typical manufacturer of the part in a five-digit code.

e. Manufacturer's part number for the part.

NOTE

The total quantity for each part is given only once – at the first appearance of the part number in the list.

Table 6-1. Reference Designations and Abbreviations (2 of 2)

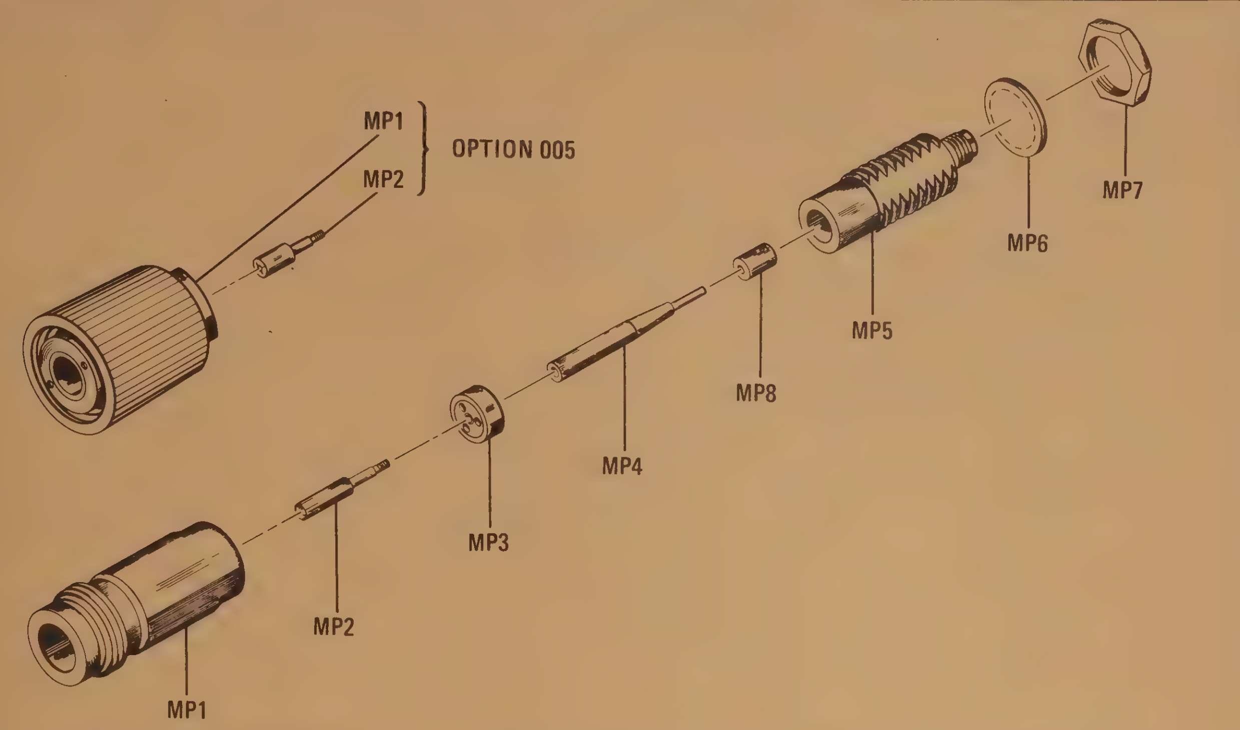
N/C . . . . normally closed
NE . . . . neon
NEG . . . . negative
nF . . . . nanofarad
NI PL . . . . nickel plate
N/O . . . . normally open
NOM . . . . nominal
NORM . . . . normal
NPN . . . . negative-positive-negative
NPO . . . . negative-positive zero (zero temperature coefficient)
NRFR . . . not recommended for field replacement
ns . . . . nanosecond
NSR . . not separetely replaceable
nW . . . . nanowatt
OBD . . . . . order by description
OD . . . . outside diameter
OH . . . . oval head
OP AMPL . . operational amplifier
OPT . . . . option
OSC . . . . oscillator
OX . . . . oxide
oz . . . . ounce
Ω . . . . ohm
P . . . . . peak (used in parts list)
PAM . . . . pulse-amplitude modulation
PC . . . . printed circuit
PCM . . . pulse-code modulation; pulse-count modulation
PDM . . pulse-duration modulation
pF . . . . picofarad
PH BRZ . . . . . phosphor bronze
PHL . . . . Phillips
PIN . . . positive-intrinsic-negative
PIV . . . . . . peak inverse voltage
pk . . . . peak
PL . . . . phase lock
PLO . . . . . phase lock oscillator
PM . . . . phase modulation
PNP . . positive-negative-positive
P/O . . . . part of
POLY . . . . polystyrene
PORC . . . . porcelain
POS . . . . . positive; position(s) (used in parts list)
POSN . . . . position
POT . . . . potentiometer
p-p . . . . peak-to-peak
PP . . . . peak-to-peak (used in parts list)
PPM . . pulse-position modulation
PREAMPL . . . . . . preamplifier
PRF . . pulse-repetition frequency
PRR . . . . . pulse-repetition rate
ps . . . . picosecond
PT . . . . point
PTM . . . . pulse-time modulation
PWM . . pulse-width modulation
PWV . . . . peak working voltage
RC . . . . . resistance-capacitance
RECT . . . . rectifier
REF . . . . reference
REG . . . . regulated
REPL . . . . replaceable
RF . . . . radio frequency
RFI . . . . radio frequency interference
RH . . . . . round head; right hand
RLC . . . . resistance-inductance-capacitance
RMO . . . . rack mount only
rms . . . . root-mean-square
RND . . . . round
ROM . . . . . . read-only memory
R&P . . . . rack and panel
RWV . . . reverse working voltage
S . . . . scattering parameter
s . . . . second (time)
. . ." . . . . . second (plane angle)
S-B . . . . slow-blow (fuse) (used in parts list)
SCR . . . . silicon controlled rectifier; screw
SE . . . . selenium
SECT . . . . sections
SEMICON . . . . . semiconductor
SHF . . . . . superhigh frequency
SI . . . . silicon
SIL . . . . silver
SL . . . . slide
SNR . . . . . signal-to-noise ratio
SPDT . . . . single-pole, double-throw
SPG . . . . spring
SPST . . single-pole, single-throw
SQ . . . . square
SR . . . . split ring
SSB . . . . single sideband
SST . . . . stainless steel
STL . . . . steel
SWR . . . . . . standing-wave ratio
SYNC . . . . synchronize
T . . . . . timed (slow-blow fuse)
TA . . . . tantalum
TC . . . temperature compensating
TD . . . . time delay
TERM . . . . terminal
TFT . . . . . . thin-film transistor
TGL . . . . toggle
THD . . . . thread
THRU . . . . through
TI . . . . titanium
TOL . . . . tolerance
TRIM . . . . trimmer
TSTR . . . . transistor
TTL . . transistor-transistor logic
TV . . . . television
TVI . . . . . television interference
TWT . . . . . . traveling wave tube
U . . . . micro (10^{-6}) (used in parts list)
UF . . . . microfarad (used in parts list)
UHF . . . . . . ultrahigh frequency
UNREG . . . . unregulated
V . . . . volt
VA . . . . voltampere
Vac . . . . volts, ac
VAR . . . . variable
VCO . . . . . . voltage-controlled oscillator
Vdc . . . . volts, dc
VDCW . . . . volts, dc, working (used in parts list)
V(F) . . . . volts, filtered
VFO . . . . . . variable-frequency oscillator
VHF . . . . . very-high frequency
Vpk . . . . volts, peak
Vp-p . . . . . . volts, peak-to-peak
Vrms . . . . volts, rms
VTO . . . . voltage-tuned oscillator
VTVM . . vacuum-tube voltmeter
V(X) . . . . volts, switched
W . . . . watt
W/ . . . . with
WIV . . . working inverse voltage
W/O . . . . without
WW . . . . wirewound
YIG . . . . . . yttrium-iron-garnet
Z_o . . . . . characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

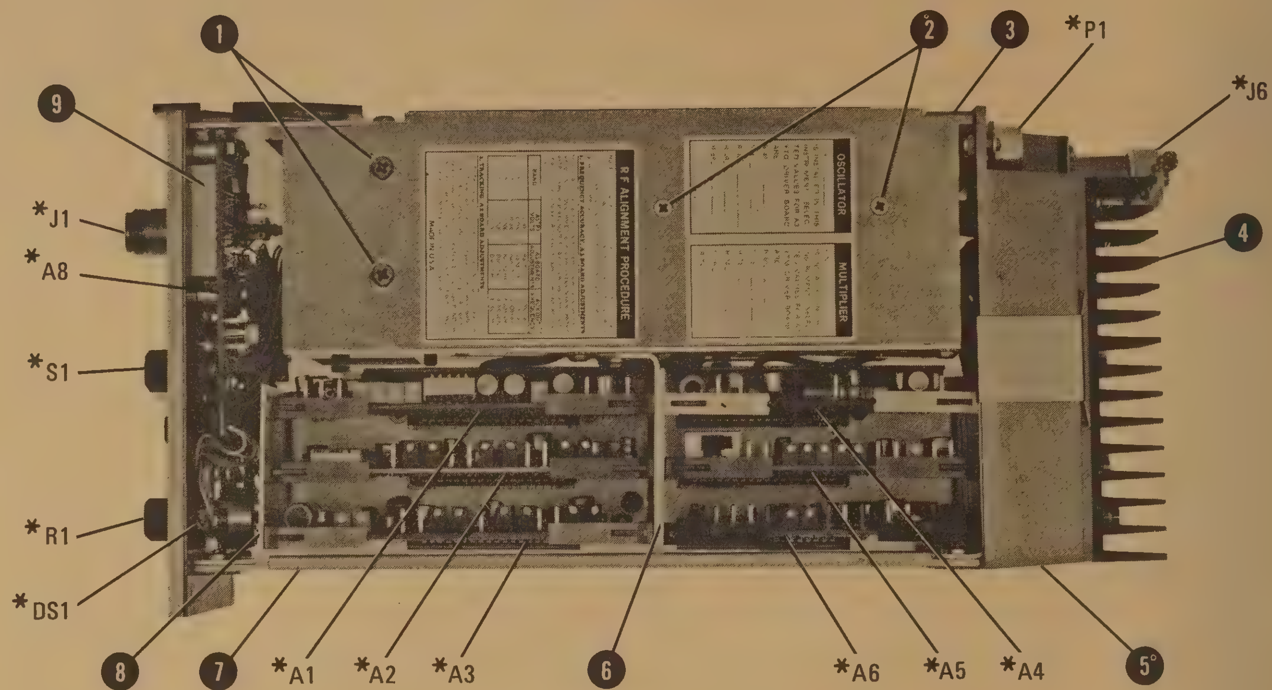
Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}



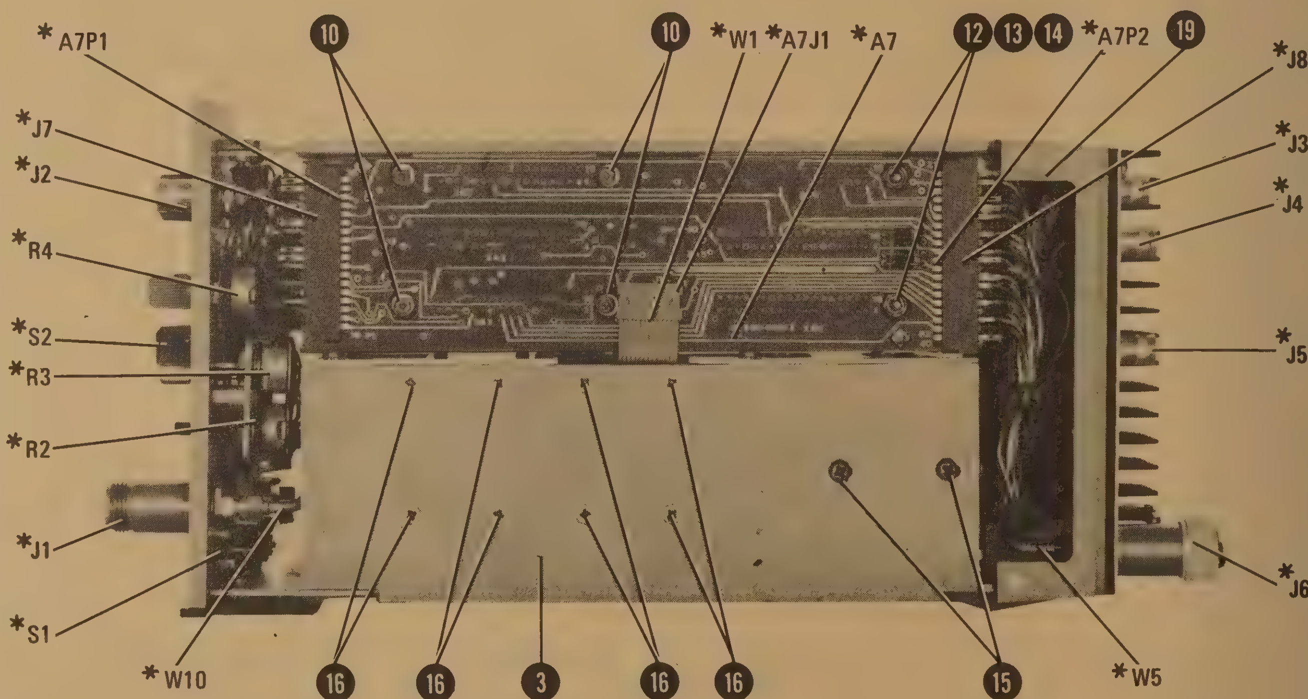
Reference Designation	HP Part Number	Description	Mfr. Code	Mfr. Part Number
J1	86290-60005	Connector Assy (Type N) (RF OUTPUT) Same as J6 (AUX OUT) Same as J9 (RF OUT Option 004)	28480	86290-60005
J1	86260-60007	Connector Assy (APC-7) (Option 005)	28480	86260-60007
J1MP1	1250-1577	Body: RF Connector (Type N)	02660	131-150
	5061-1151	RF Connector Replacement Kit (Includes HP Part No. 1250-1577) (Preferred Replacement)		
J1MP1	1250-0909	Body: RF Connector (APC-7) (Option 005)	28480	1250-0909
J1MP2	1250-0915	Contact: RF Connector (Type N)	02660	131-149
J1MP2	1250-0816	Contact: RF Connector (APC-7) (Option 005)	28480	1250-0816
J1MP3	5040-0306	Insulator	28480	5040-0306
J1MP4	08555-20093	Center Conductor	28480	08555-20093
J1MP5	08555-20094	Body: Bulkhead	28480	08555-20094
J1MP6	2190-0104	Washer: Lock 0.439″ ID	00000	OBD
J1MP7	2950-0132	Nut: Hex 7/16 – 28	00000	OBD
J1MP8	08761-2027	Insulator	28480	08761-2027

Figure 6-1. RF Output Connector, Exploded View

TOP VIEW



BOTTOM VIEW



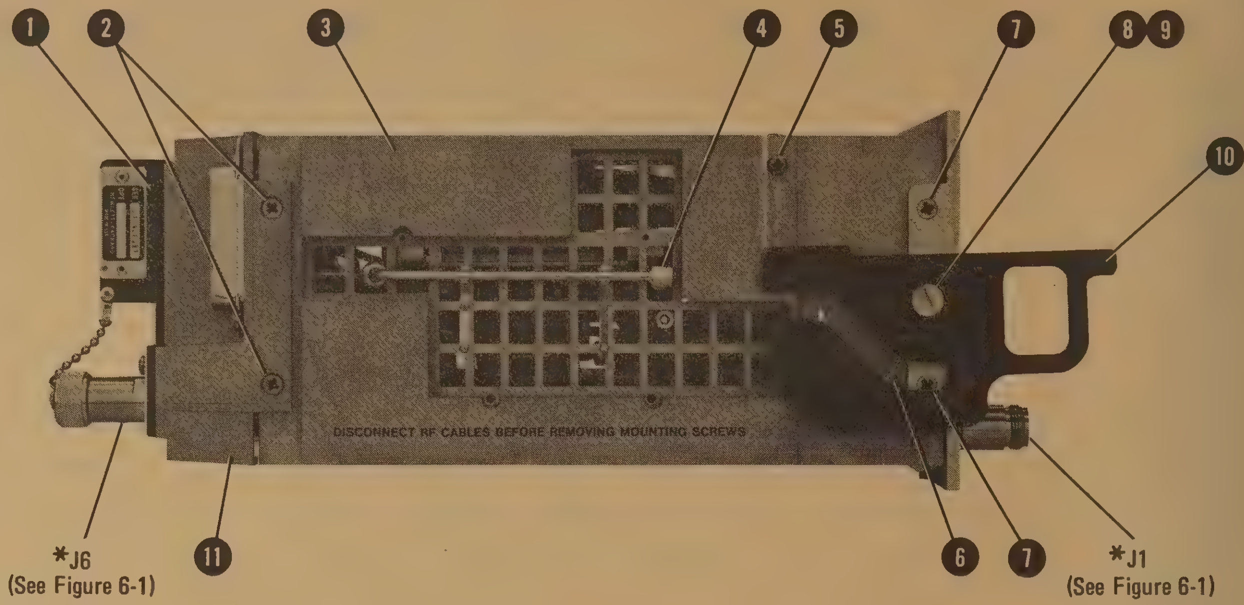
*Refer to Table 6-2 for Part Number Information

Figure 6-2. Overall Instrument Parts Identification (1 of 4)

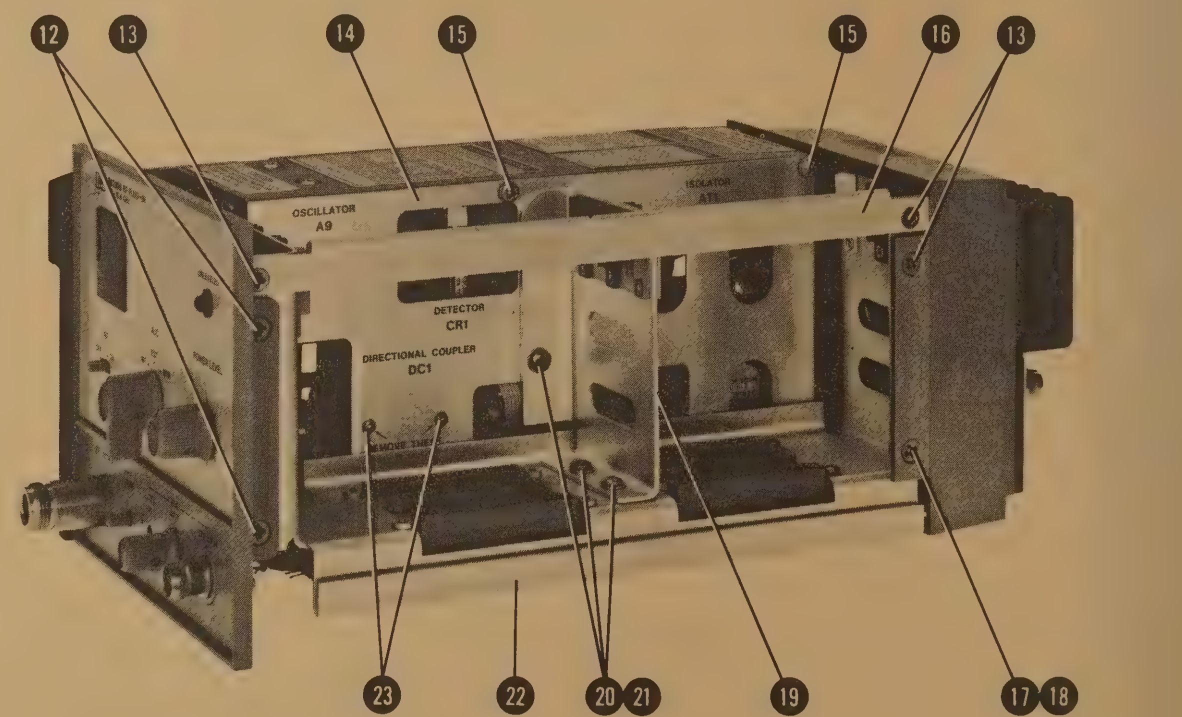
Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	2360-0332	SCREW: 6-32 PAN HEAD	04886	YELLOW PATCH
2	2200-0165	SCREW: 4-40, .25 IN LG, 82° FLH	28480	2200-0165
3	86290-20008	HEAT SINK: RF SECTION FRAME	28480	86290-20008
4	86290-20003	PANEL: REAR	28480	86290-20003
5	86290-20002	FRAME: REAR	28480	86290-20002
6	86290-00008	BRACKET: BOARD SUPPORT	28480	86290-00008
7	86260-00012	BRACE: DRAWER	28480	86260-00012
8	86290-00006	DECK: MAIN	28480	86290-00006
9	08672-40001	HOUSING: LAMP	28480	08672-40001
10	2200-0111	SCREW: 4-40, .5 IN LG, PAN HEAD	28480	2200-0111
11	2200-0115	SCREW: 4-40, .75 IN LG, PAN HEAD	28480	2200-0115
12	0590-0076	NUT: (FOR SCREW 11)	72962	22NM-40
13	2260-0009	NUT: (TO ATTACH EXTENDER BOARD)	28480	2260-0009
14	2360-0115	SCREW: 6-32, .312 IN LG, PAN HEAD	28480	2360-0115
15	2200-0172	SCREW: 4-40, .875 IN LG, 82° FLH	28480	2200-0172
16	2260-0009	NUT: (FOR SCREW 16)	28480	2260-0009
17	0380-0793	SPACER: POST (FOR MOUNTING BRACKET 18)	76854	15525-610
18	86290-00025	BRACKET: POT (MOUNTING BRACKET FOR R2 AND R3)	28480	86290-00025
19	6960-00016	HOLE PLUG: PLASTIC	02768	207-080501-01-0101

Figure 6-2. Overall Instrument Parts Identification (2 of 4)

LEFT SIDE VIEW



RIGHT SIDE VIEW

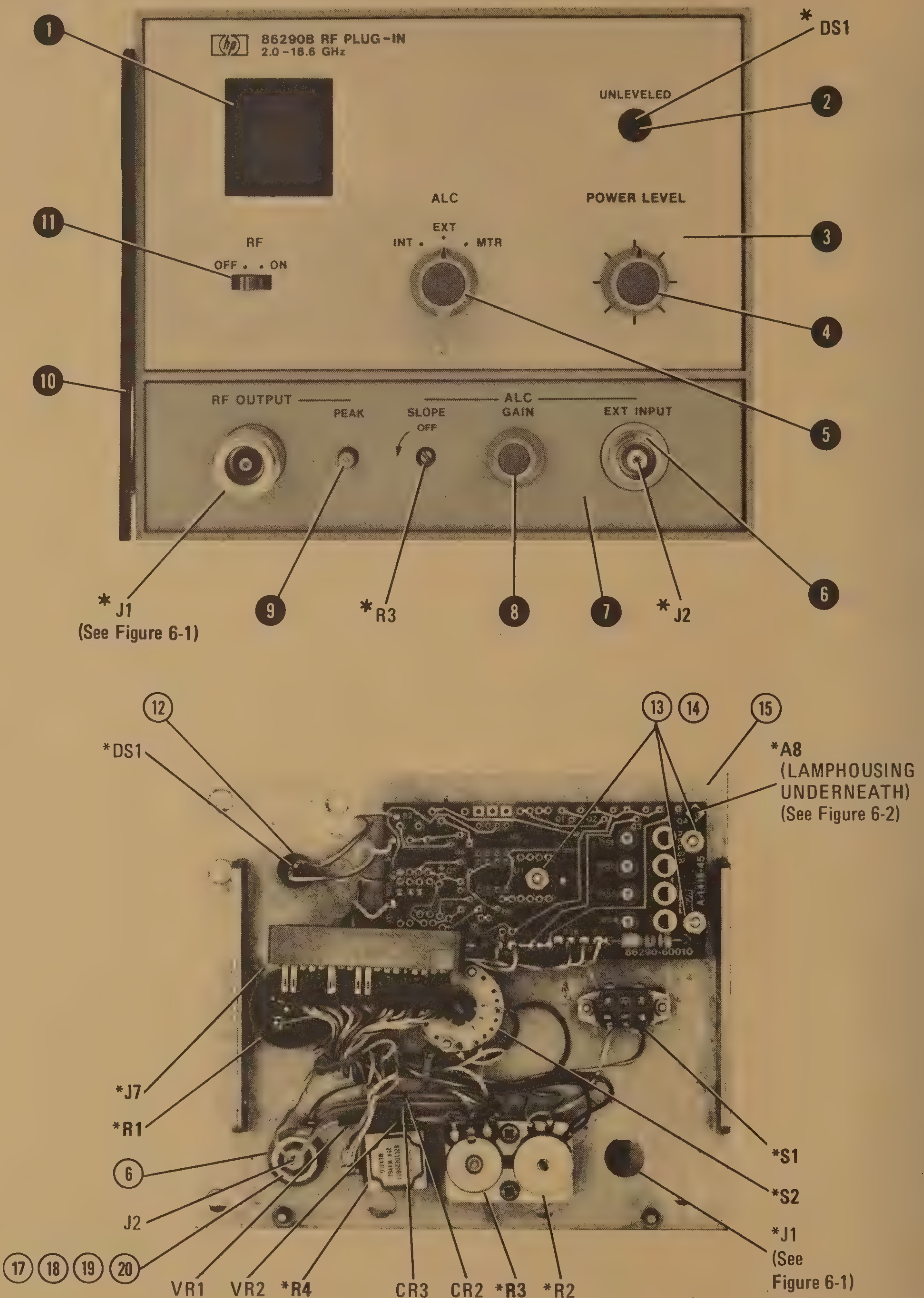


*Refer to Table 6-2 for Part Number Information

Figure 6-2. Overall Instrument Parts Identification (3 of 4)

Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	86290-20003	PANEL: REAR	28480	86290-20003
2	2360-0182	SCREW: (TO ATTACH REAR FRAME 11)	28480	2360-0182
3	86290-20008	HEAT SINK: RF SECTION FRAME	28480	86290-20008
4	86290-20032	CABLE: RF TEST (P/O ACCESSORIES SUPPLIED)	28480	86290-20032
5	2360-0117	SCREW: (TO ATTACH YTO A9)	28480	2360-0117
6	1460-1186	WIREFORM (FOR LATCH HANDLE)	28480	1460-1186
7	2360-0182	SCREW: (TO ATTACH FRONT PANEL ASSY)	28480	2360-0182
8	08621-20052	SCREW (FOR LATCH HANDLE)	28480	08621-20052
9	3050-0028	WASHER: FLAT (FOR LATCH HANDLE)	28480	3050-0028
10	08621-20051	HANDLE: DRAWER LATCH	28480	08621-20051
11	86290-20002	FRAME: REAR	28480	86290-20002
12	2360-0182	SCREW: (TO ATTACH FRONT PANEL ASSY)	28480	2360-0182
13	2360-0192	SCREW: (TO ATTACH BRACE 16 AND REAR FRAME 11)	28480	2360-0192
14	86290-00009	LID: RF SECTION	28480	86290-00009
15	2360-0115	SCREW: (TO ATTACH LID 14)	28480	2360-0115
16	86260-00012	BRACE: DRAWER	28480	86260-00012
17	2360-0182	SCREW: (TO ATTACH REAR FRAME 11)	28480	2360-0182
18	2420-0001	NUT: HEX (FOR SCREW 17)	28480	2420-0001
19	86290-00008	BRACKET: BOARD SUPPORT	28480	86290-00008
20	2360-0332	SCREW: (TO ATTACH BRACKET 19)	04866	YELLOW PATCH
21	3050-0010	WASHER: (FOR SCREW 20)	76210	65
22	86290-00006	DECK: MAIN	28480	86290-00006
23	0520-0173	SCREW: (TO FASTEN DIRECTIONAL COUPLER DC1 TO LID 14)	28480	0520-0173

Figure 6-2. Overall Instrument Parts Identification (4 of 4)

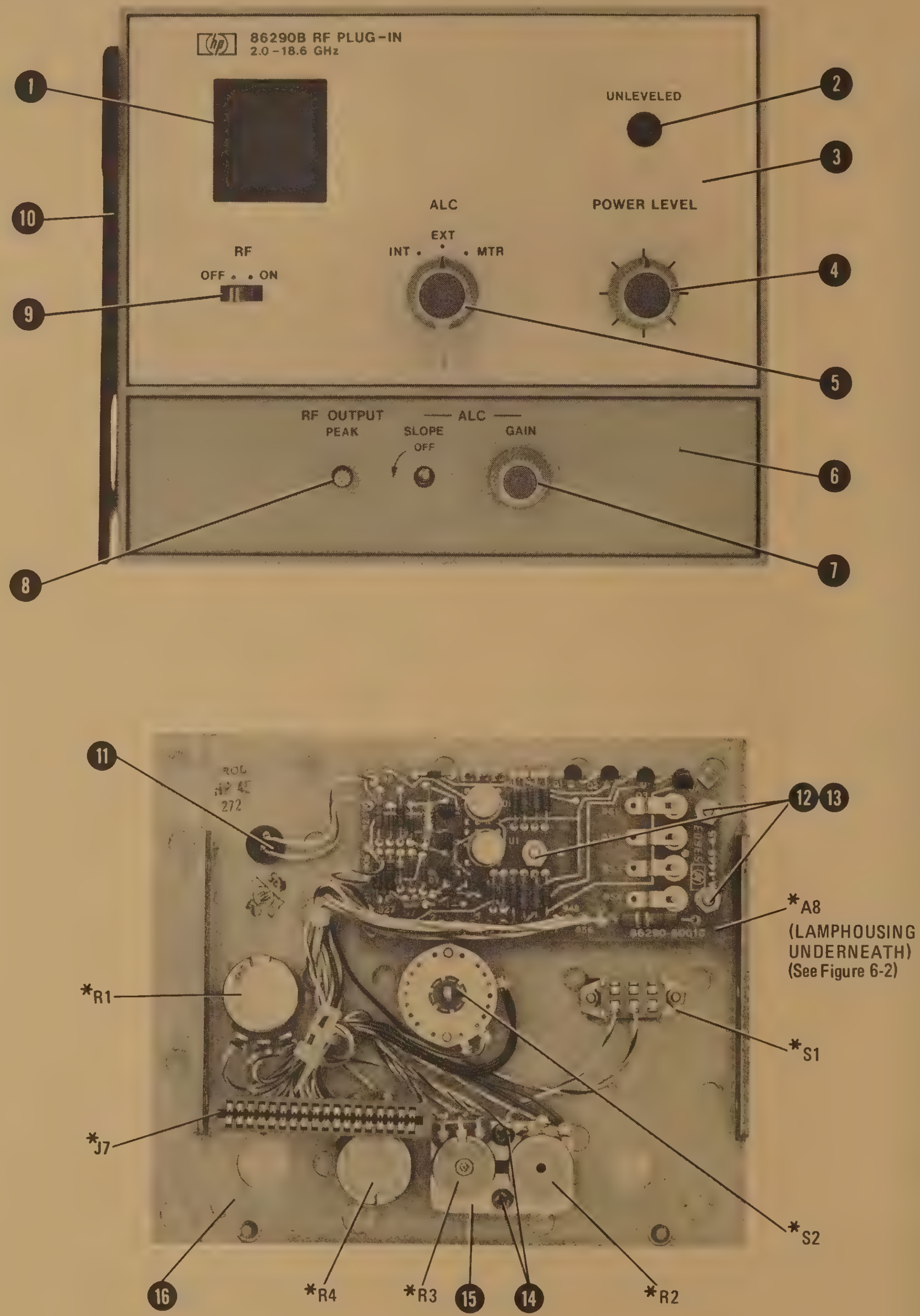


*Refer to Table 6-2 for Part Number Information

Figure 6-3. Front Panel Parts Identification (1 of 4)

Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	86290-20060	WINDOW: BAND SELECTOR	28480	86290-20060
2	1400-0560	CLIP: LED MOUNTING WITH RETAINER RING 12	28480	1400-0560
3	86290-00065	PANEL: UPPER FRONT	28480	86290-00065
4	0370-1099	KNOB: POINTER (POWER LEVEL)	28480	0370-1099
5	0370-2994	KNOB: BAR (ALC SWITCH)	28480	0370-2994
6	5040-0345	INSULATOR: CONNECTOR (FOR ALC EXT INPUT)	28480	5040-0345
7	86290-00063	PANEL: LOWER FRONT	28480	86290-00063
8	0370-1001	KNOB: ROUND (ALC GAIN)	28480	0370-1001
9	86240-20045	KNOB: KNURLED (PEAK)	28480	86240-20045
10	08621-20051	HANDLE: DRAWER LATCH	28480	08621-20051
11	08640-40052	LEVER: SLIDE SWITCH (RF OFF-ON)	28480	08640-40052
		RETAINER RING: (P/O CLIP 2)		
12	2260-0001	NUT: HEX (TO ATTACH A8 ASSY)	28480	2260-0001
13	2190-0019	WASHER (FOR NUT 13)	28480	2190-0019
14	86290-20001	PANEL: SUB FRONT	28480	86290-20001
15	2200-0105	SCREW: (TO ATTACH POT BRACKET 17)	28480	2200-0105
16	86290-00025	BRACKET: POT (MOUNTING PLATE FOR R2 AND R3)	28480	86290-00025
17	2950-0001	NUT: HEX (FOR ALC EXT INPUT)	12697	20/4-13
18	2190-0016	WASHER: LOCK (FOR ALC EXT INPUT)	78189	1920-02
19	0360-1190	LUG: GROUND (FOR ALC EXT INPUT)	79963	720-.380H
20	0360-0268	TERMINAL SOLDER LUG #6SCR	79963	804-.138

Figure 6-3. Front Panel Parts Identification (2 of 4)

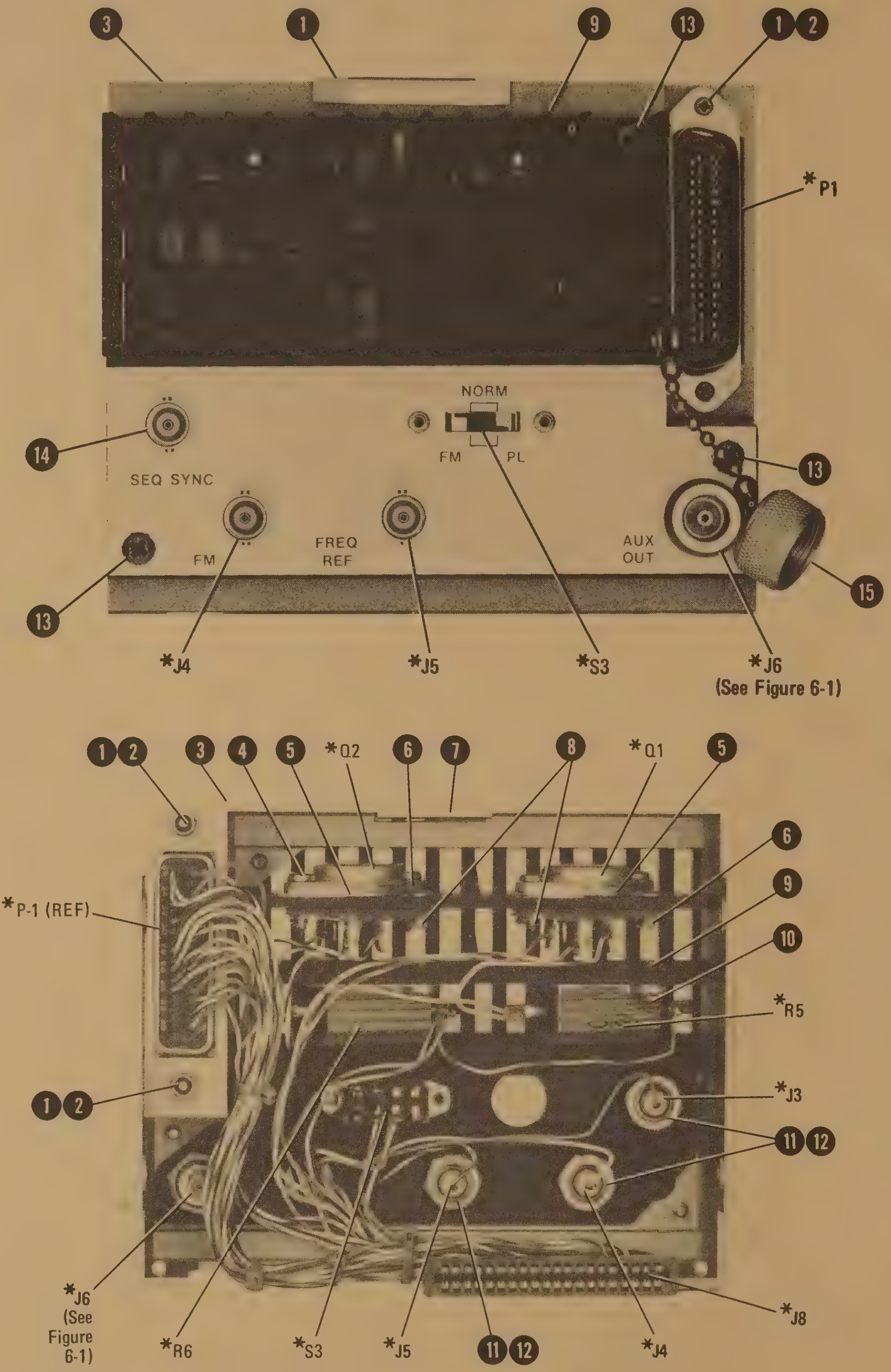


*See Table 6-2 for Part Number Information

Figure 6-3. Front Panel Parts Identification (3 of 4), Option 004

Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	86290-20060	WINDOW: BAND SELECTOR	28480	86290-20060
2	1400-0560	CLIP: LED MOUNTING WITH RETAINER RING 11	28480	1400-0560
3	86290-00065	PANEL: UPPER FRONT	28480	86290-00065
4	0370-1099	KNOB: POINTER (POWER LEVEL)	28480	0370-1099
5	0370-2994	KNOB: BAR (ALC SWITCH)	28480	0370-2994
6	86290-00064	PANEL: LOWER FRONT	28480	86290-00064
7	0370-1001	KNOB: ROUND (ALC GAIN)	28480	0370-1001
8	86240-20045	KNOB: KNURLED (PEAK)	28480	86240-20045
9	08640-40052	LEVER: SLIDE SWITCH (RF OFF-ON)	28480	08640-40052
10	08621-20051	HANDLE: DRAWER LATCH	28480	08621-20051
		RETAINER RING: (P/O CLIP 2)		
11	2260-0001	NUT: HEX (TO ATTACH A8 ASSY)	28480	2260-0001
12	2190-0019	WASHER: LOCK (FOR NUT 12)	28480	2190-0019
13	2200-0105	SCREW: (TO ATTACH POT BRACKET 16)	28480	2200-0105
14	86290-00025	BRACKET: POT (MOUNTING PLATE FOR R2 AND R3)	28480	86290-00025
15	86290-20001	PANEL: SUB FRONT	28480	86290-20001

Figure 6-3. Front Panel Parts Identification (4 of 4), Option 004

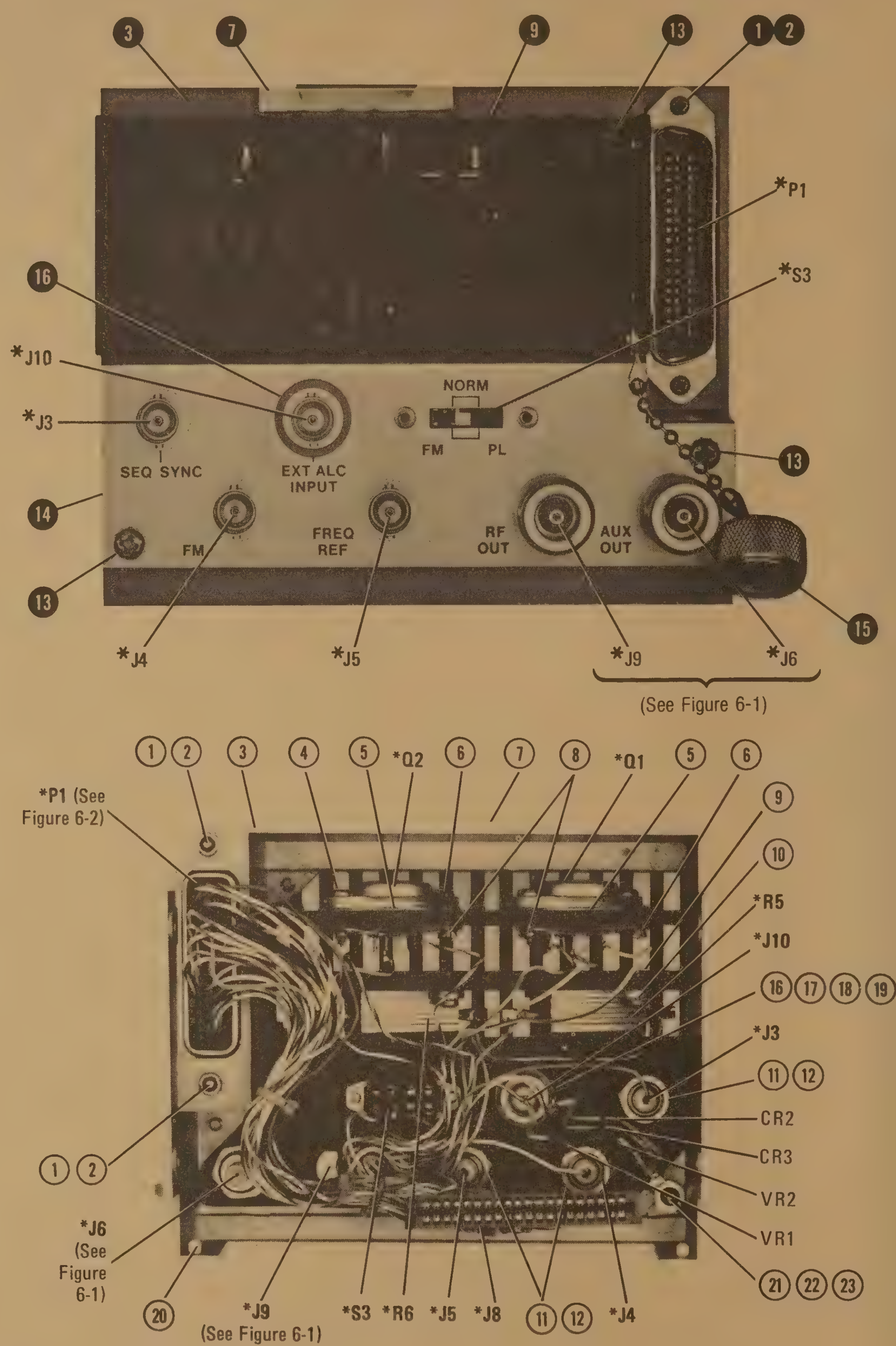


*See Table 6-2 for Part Number Information

Figure 6-4. Rear Panel Parts Identification (1 of 4)

Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	0590-0106	NUT: LOCK	72962	22NM-26
2	0590-0131	SCREW: CONNECTOR	28480	0590-0131
3	86290-20002	FRAME: REAR	28480	86290-20002
4	0626-0002	SCREW: 6-20, .5 IN LG, PAN HEAD	28480	0626-0002
5	1200-0043	INSULATOR: TRANSISTOR	76530	322047
6	0361-0520	RIVET: BLIND, .125 IN	28480	0361-0520
7	08621-00006	SPRING: GROUND	28480	08621-00006
8	1200-0041	SOCKET: TRANSISTOR	22753	PTS-1
9	86290-20003	PANEL: REAR	28480	86290-20003
10	2200-0105	SCREW: PAN HEAD, 4-40, .312 IN LG	28480	2200-0105
11	2950-0132	NUT: HEX 7/16 IN, .094 THK	73734	76500NP
12	2190-0104	WASHER: LOCK, INTL T, 7/16 IN	78189	1922-04
13	2360-0117	SCREW: 6-32, .375 IN LG, PAN HEAD	28480	2360-0117
14	86290-00022	PANEL: REAR COVER	28480	86290-00022
15	1250-0522	CAP: COAXIAL TYPE-N	24931	25PC100-1
16	6960-0016	HOLE PLUG: PLASTIC	02768	207-080501-01-0101

Figure 6-4. Rear Panel Parts Identification (2 of 4)



*See Table 6-2 for Part Number Information

Figure 6-4. Rear Panel Parts Identification (3 of 4), Option 004

Item	HP Part Number	Description	Mfr. Code	Manufacturer's Part Number
1	0590-0106	NUT: LOCK	72962	22NM-26
2	0590-0131	SCREW: CONNECTOR	28480	0590-0131
3	86290-20002	FRAME: REAR	28480	86290-20002
4	0626-0002	SCREW: 6-20, .5 IN LG, PAN HEAD	28480	0626-0002
5	1200-0043	INSULATOR: TRANSISTOR	76530	322047
6	0361-0520	RIVET: BLIND, .125 IN	28480	0361-0520
7	08621-00006	SPRING: GROUND	28480	08621-00006
8	1200-0041	SOCKET: TRANSISTOR	22753	PTS-1
9	86290-20003	PANEL: REAR	28480	86290-20003
10	2200-0105	SCREW: PAN HEAD, 4-40, .312 IN LG	28480	2200-0105
11	2950-0132	NUT: HEX, 7/16, .094 THK	73734	76500NP
12	2190-0104	WASHER: LOCK, 3/8 IN	78189	1922-04
13	2360-0117	SCREW: 6-32, .375 IN LG, PAN HEAD	28480	2360-0117
14	86290-00023	PANEL: REAR COVER	28480	86290-00023
15	1250-0522	CAP: COAXIAL TYPE-N	24931	25PC100-1
16	5040-0345	INSULATOR: CONNECTOR (FOR ALC EXT INPUT)	28480	5040-0345
17	0360-1190	LUG: GROUND (FOR ALC EXT INPUT)	79963	720-.380H
18	2950-0001	NUT: HEX (FOR ALC EXT INPUT)	12697	20/4-13
19	2190-0016	WASHER: LOCK (FOR ALC EXT INPUT)	78189	1920-02
20	6960-0016	HOLE PLUG: PLASTIC	02768	207-080501-01-0101
21	2360-0127	SCREW: 6-32	28480	2360-0127
22	2420-0001	NUT: 6-32	28480	2420-0001
23	0360-0268	TERMINAL SOLDER LUG #6SCR	79963	804-.138

Figure 6-4. Rear Panel Parts Identification (4 of 4), Option 004

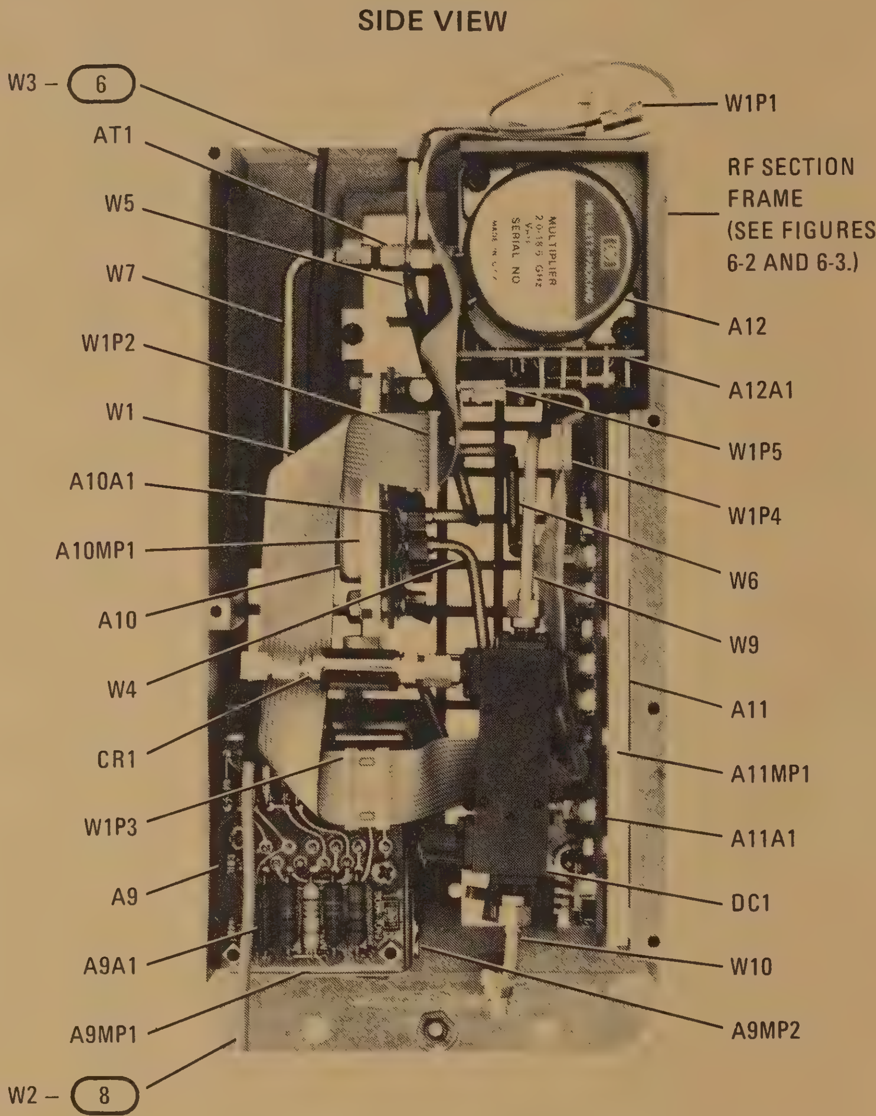


Figure 6-5. RF Section, Major Assembly and Component Locations (1 of 2)

SIDE VIEW
OPTION 004

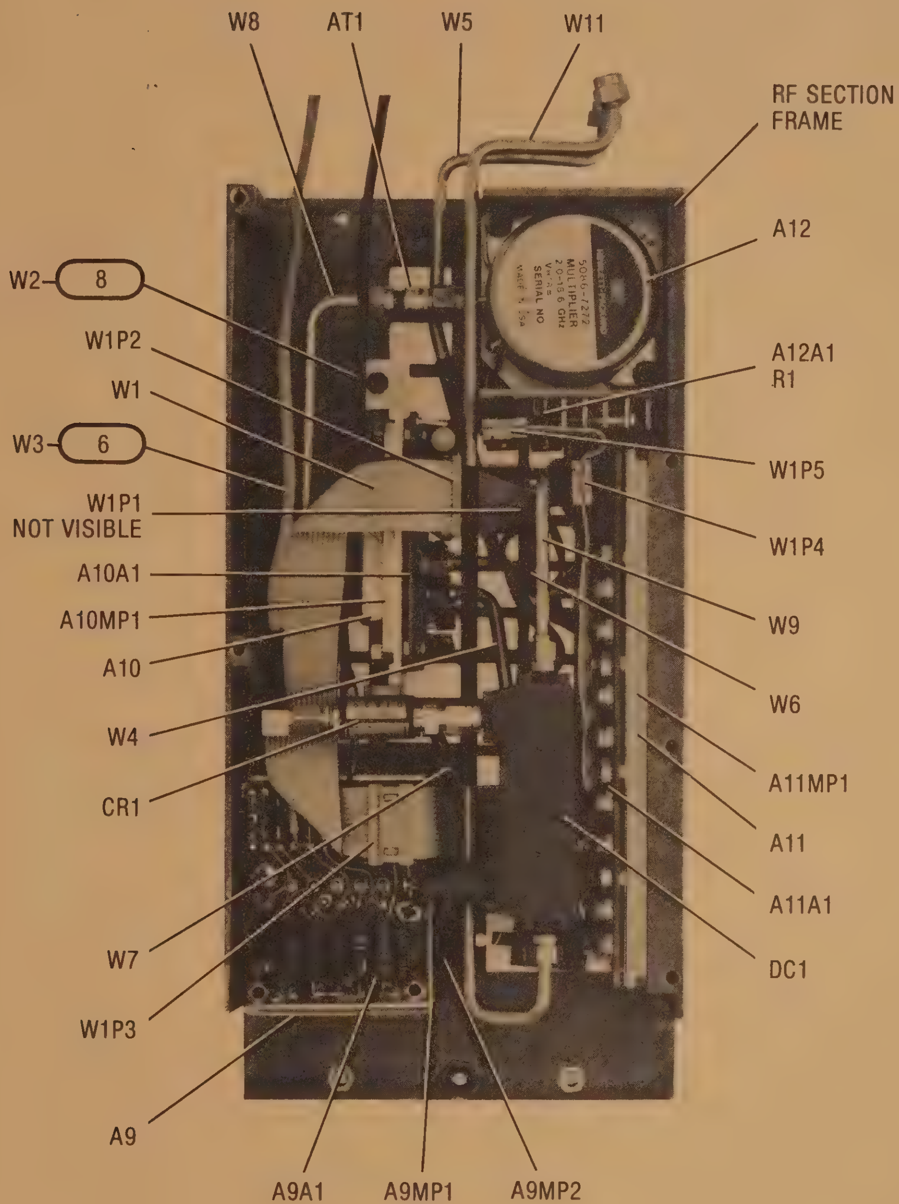


Figure 6-5. RF Section, Major Assembly and Component Locations (2 of 2), Option 004

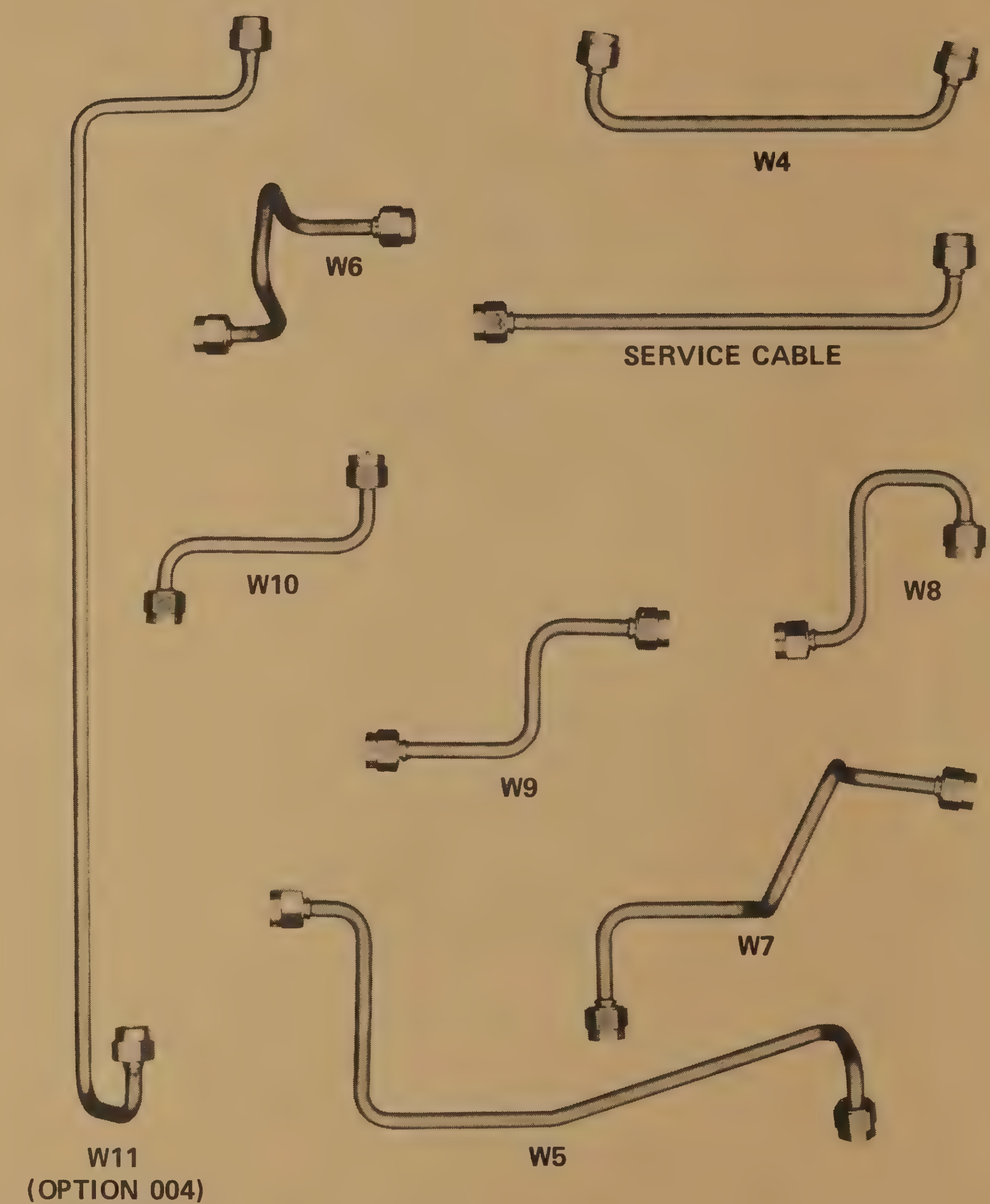


Figure 6-6. RF Cable Assemblies

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	**86290-60121**	8	1	**BOARD ASSY, ALC**	**28480**	**86290-60121**
	86290-60072			ALC ASSY, REPLACEMENT KIT	28480	86290-60072
A1C1	0160-0127	2	6	CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C2	0140-0196	3	1	CAPACITOR-FXD 150PF +5% 300VDC MICA	72136	DM15F151J0300WV1CR
A1C3	0160-2240	4	1	CAPACITOR-FXD 2PF +.25PF 500VDC CER	28480	0160-2240
A1C4	0160-2036	6	1	CAPACITOR-FXD 4300PF +5% 500VDC MICA	28480	0160-2036
A1C5	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C6	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C7	0160-2256	2	1	CAPACITOR-FXD 9.1PF +.25PF 500VDC CER	28480	0160-2256
A1C8	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C9	0160-2242	6	1	CAPACITOR-FXD 2.4PF +.25PF 500VDC CER	28480	0160-2242
A1C10	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C11	0160-3873	1	1	CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A1C12	0160-2201	7	1	CAPACITOR-FXD 51PF +5% 300VDC MICA	28480	0160-2201
A1C13	0160-3067	5	1	CAPACITOR-FXD 200PF +5% 300VDC MICA	28480	0160-3067
A1C14	0180-0291	3	1	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A1C15	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A1C16	0160-0205	7	1	CAPACITOR-FXD 10PF +5% 500VDC MICA	28480	0160-0205
A1CR1	1901-0376	6	10	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR6				NOT ASSIGNED		
A1CR7	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR8	1901-0518	8	8	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR9	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR10	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR11	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR12	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR13	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR14	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR15	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR16	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A1CR17	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR18	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR19	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A1CR20	1901-0197	9	2	DIODE-SCHOTTKY 12V 100PS	28480	1901-0197
A1CR21	1901-0197	9		DIODE-SCHOTTKY 12V 100PS	28480	1901-0197
A1J1	1250-0836	2	1	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0836
A1MP1	4040-0749	4	2	EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A1MP2	4040-0749	4		EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A1MP3	1200-0173	5	1	INSULATOR-XSTR DAP-GL	28480	1200-0173
A1MP4	1480-0073	6	4	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A1MP5	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A1Q1	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q2	1854-0039	7	1	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L585	2N3053S
A1Q3	1854-0023	9	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A1Q4	1855-0062	8	10	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q5	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A1Q6	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A1Q7	1853-0050	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A1Q8	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1Q9	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q10	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q11	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q12	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q13	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q14	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q15	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q16	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1Q17	1855-0062	8		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A1R1	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+100	28480	0757-0180
A1R2	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+100	28480	0757-0180
A1R3	0698-7260	7	15	RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A1R4	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A1R5	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A1R6	0698-7236	7	9	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A1R7	2100-2413	9	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A1R8	0698-7246	9	5	RESISTOR 2.61K 1% .05W F TC=0+100	24546	C3-1/8-T0-2611-F
A1R9	0757-0421	4	14	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A1R10	2100-2574	3	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R11	0698-7243	6	5	RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A1R12	0698-7283	4	1	RESISTOR 90.9K 1% .05W F TC=0±100	24546	C3-1/8-T0-9092-F
A1R13	0698-7246	9		RESISTOR 2.61K 1% .05W F TC=0±100	24546	C3-1/8-T0-2611-F
A1R14	0698-7246	9		RESISTOR 2.61K 1% .05W F TC=0±100	24546	C3-1/8-T0-2611-F
A1R15	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R16	0698-7274	3	1	RESISTOR 38.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-3832-F
A1R17	0698-7284	5	7	RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R18	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R19	0698-7277	6	4	RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-F
A1R20*	0698-7252	7	2	RESISTOR 4.64K 1% .05W F TC=0±100	24546	C3-1/8-T0-4641-F
A1R21	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R22	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R23*	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0±100	24546	C3-1/8-T0-4641-F
A1R24	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A1R25	0698-7264	1	1	RESISTOR 14.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-1472-F
A1R26	0698-7270	9	2	RESISTOR 26.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-2612-F
A1R27	0698-7253	8	7	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R28	0698-7273	2	1	RESISTOR 34.8K 1% .05W F TC=0±100	24546	C3-1/8-T0-3482-F
A1R29	2100-3094	4	2	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A1R30	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0±100	24546	C4-1/8-T0-2153-F
A1R31	0698-7246	9		RESISTOR 2.61K 1% .05W F TC=0±100	24546	C3-1/8-T0-2611-F
A1R32	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-F
A1R33	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R34	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R35	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-F
A1R36	2100-3162	7	2	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	02111	43P204
A1R37	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A1R38	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R39	0698-7234	5	1	RESISTOR 825 1% .05W F TC=0±100	24546	C3-1/8-T0-825R-F
A1R40	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R41	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R42	2100-3094	4		RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A1R43	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R44	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R45	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R46	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A1R47	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R48	0698-7258	3	3	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-F
A1R49	0698-7229	8	1	RESISTOR 511 1% .05W F TC=0±100	24546	C3-1/8-T0-511R-F
A1R50	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-F
A1R51	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R52	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R53	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R54	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R55	2100-3162	7		RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	02111	43P204
A1R56	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R57	0698-7270	9		RESISTOR 26.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-2612-F
A1R58	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R59	2100-2030	6	1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A1R60	2100-3122	9	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	02111	43P101
A1R61	0698-7238	9	1	RESISTOR 1.21K 1% .05W F TC=0±100	24546	C3-1/8-T0-1211-F
A1R62	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R63	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R64	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R65	0698-7271	0	2	RESISTOR 28.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-2872-F
A1R66				NOT ASSIGNED		
A1R67	0698-7258	3		RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-F
A1R68	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R69	0698-7284	5		RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A1R70	0698-7271	0		RESISTOR 28.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-2872-F
A1R71	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A1R72	0698-7230	1	1	RESISTOR 562 1% .05W F TC=0±100	24546	C3-1/8-T0-562R-F
A1R73	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R74	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R75	2100-2489	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A1R76	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R77	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R78	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-F
A1R79	0698-7258	3		RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-F
A1R80	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A1R81	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A1R82	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A1R83	0698-7244	7	1	RESISTOR 2.15K 1% .05W F TC=0±100	24546	C3-1/8-T0-2151-F
A1R84	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R85	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A1R86	0698-7208	3	1	RESISTOR 68.1 1% .05W F TC=0±100	24546	C3-1/8-TO-68R1-F
A1R87	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A1R88	0698-7246	9		RESISTOR 2.61K 1% .05W F TC=0±100	24546	C3-1/8-T0-2611-F
A1S1	3101-1860	1	1	SWITCH-SL 5-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1860
A1U1	1826-0218	5	4	IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1U2	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1U3	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1U4	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A1U5	1820-1526	8	1	IC DCDR CMOS BCD-TO-DEC 4-TO-10-LINE	04713	MC14028BCL
A1U6	1820-0223	0	1	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A1U7	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1VR1	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A1VR2	1902-0048	1	1	DIODE-ZNR 6.81V 5% DO-35 PD=.4W	28480	1902-0048
A1VR3	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	24046	1N827
A1W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	**86290-60104**	**7**	**1**	**BOARD ASSY, YIG TUNED MULTIPLIER DRIVER**	**28480**	**86290-60104**
A2C1	0160-4084	8	2	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C2	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C3	0160-0300	3	1	CAPACITOR-FXD 2700PF +10% 200VDC POLYE	28480	0160-0300
A2C4	0180-0373	2	1	CAPACITOR-FXD .68UF+10% 35VDC TA	56289	150D684X9035A2
A2C5	0160-3809	3	2	CAPACITOR-FXD .39UF +5% 50VDC MET-POLYC	28480	0160-3809
A2C6	0160-3809	3		CAPACITOR-FXD .39UF +5% 50VDC MET-POLYC	28480	0160-3809
A2CR1	1901-0033	2	5	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2MP1	4040-0750	7	2	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A2MP2	4040-0750	7		EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A2MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A2MP4	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A2Q1	1855-0421	3	3	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A2Q2	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A2Q3	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A2Q4	1855-0062	8	1	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A2Q5	1855-0082	2	3	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A2Q6	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A2Q7	1853-0044	2	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A2Q8	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A2Q9	1854-0474	4	2	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q10	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q11	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A2R1	2100-0635	3	4	RESISTOR-TRMR 2K 10% C SIDE-ADJ 20-TRN	28480	2100-0635
A2R2	2100-0635	3		RESISTOR-TRMR 2K 10% C SIDE-ADJ 20-TRN	28480	2100-0635
A2R3	2100-0635	3		RESISTOR-TRMR 2K 10% C SIDE-ADJ 20-TRN	28480	2100-0635
A2R4	2100-0636	4	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 20-TRN	28480	2100-0636
A2R5	2100-0635	3		RESISTOR-TRMR 2K 10% C SIDE-ADJ 20-TRN	28480	2100-0635
A2R6	2100-0637	5	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 20-TRN	28480	2100-0637
A2R7	0757-0488	3	1	RESISTOR 909K 1% .125W F TC=0+100	28480	0757-0488
A2R8	0698-8468	9	4	RESISTOR 25K .1% .1W F TC=0+4	28480	0698-8468
A2R9	0698-8468	9		RESISTOR 25K .1% .1W F TC=0+4	28480	0698-8468
A2R10	0698-6407	2	1	RESISTOR 32.8K .1% .1W F TC=0+4	28480	0698-6407
A2R11	0757-0485	0	1	RESISTOR 681K 1% .125W F TC=0+100	28480	0757-0485
A2R12	0698-8468	9		RESISTOR 25K .1% .1W F TC=0+4	28480	0698-8468
A2R13	0698-8483	8	1	RESISTOR 6.31K .1% .1W F TC=0+4	28480	0698-8483
A2R14	0698-8500	0	1	RESISTOR 16.58K .1% .1W F TC=0+4	28480	0698-8500
A2R15	0698-3260	9	2	RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A2R16	0698-8468	9		RESISTOR 25K .1% .1W F TC=0+4	28480	0698-8468
A2R17	0698-8484	9	1	RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A2R18	0698-6406	1	1	RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A2R19	0683-6855	3	1	RESISTOR 6.8M 5% .25W FC TC=-900/+1100	01121	CB6855
A2R20	0698-8488	3	1	RESISTOR 14.1K .1% .1W F TC=0+4	28480	0698-8488
A2R21	0698-8492	9	1	RESISTOR 21.7K .1% .1W F TC=0+4	28480	0698-8492
A2R22	0698-8493	0	1	RESISTOR 22.4K .1% .1W F TC=0+4	28480	0698-8493
A2R23	0757-0344	0	1	RESISTOR 1M 1% .25W F TC=0+100	24546	C5-1/4-T0-1004-F
A2R24	0698-7247	0	1	RESISTOR 2.87K 1% .05W F TC=0+100	24546	C3-1/8-T0-2871-F
A2R25	2100-2655	1	1	RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	73138	82PR100K
A2R26	2100-2497	9	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	82PR2K
A2R27	2100-2650	6	1	RESISTOR-TRMR 200K 10% C TOP-ADJ 1-TRN	73138	82PR200K
A2R28	0698-7253	8	2	RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A2R29	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A2R30	0698-7277	6	5	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A2R31	2100-1738	9	4	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A2R32	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A2R33	0698-7270	9	2	RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-2612-F
A2R34	0698-3453	2	2	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A2R35	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A2R36	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A2R37	0698-7270	9		RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-2612-F
A2R38	2100-2030	6	5	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A2R39	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A2R40	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A2R41	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A2R42	0698-7265	2	3	RESISTOR 16.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-1622-F
A2R43	0698-7267	4	3	RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A2R44	0698-7265	2		RESISTOR 16.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-1622-F
A2R45	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R46	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A2R47	0698-7265	2		RESISTOR 16.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-1622-F
A2R48	0698-7288	9	4	RESISTOR 147K 1% .05W F TC=0+100	24546	C3-1/8-T0-1473-F
A2R49	0698-7288	9		RESISTOR 147K 1% .05W F TC=0+100	24546	C3-1/8-T0-1473-F
A2R50	0698-7288	9		RESISTOR 147K 1% .05W F TC=0+100	24546	C3-1/8-T0-1473-F
A2R51	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A2R52	0698-7288	9		RESISTOR 147K 1% .05W F TC=0+100	24546	C3-1/8-T0-1473-F
A2R53	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A2R54	0698-7260	7	3	RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R55	2100-2031	7	1	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	82PR50K
A2R56	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A2R57	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A2R58	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R59	0811-0931	7	1	RESISTOR 660 1% 1W PW TC=0+20	91637	RS-1A-T9-661-F
A2R60*				*FACTORY SELECTED PART		
A2R61	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R62	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A2R63	0698-7263	0	3	RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-1332-F
A2R64	0698-7251	6	2	RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3-1/8-T0-4221-F
A2R65*				*FACTORY SELECTED PART		
A2R66	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-1332-F
A2R67	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A2R68	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A2R69	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-1332-F
A2R70	0698-7273	2	2	RESISTOR 34.8K 1% .05W F TC=0+100	24546	C3-1/8-T0-3482-F
A2R71	0698-7273	2		RESISTOR 34.8K 1% .05W F TC=0+100	24546	C3-1/8-T0-3482-F
A2R72	0698-7251	6		RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3-1/8-T0-4221-F
A2R73*				*FACTORY SELECTED PART		
A2R74*				*FACTORY SELECTED PART		
A2R75	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A2R76*				*FACTORY SELECTED PART		
A2R77	0698-7262	9	1	RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1212-F
A2R78	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A2R79*				*FACTORY SELECTED PART		
A2R80	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+100	24546	C3-1/8-T0-3161-F
A2R81	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A2U1	1826-0261	8	2	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A2U2	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A2U3	1820-1542	8	1	IC BFR CMOS INV HEX 1-INP	3L585	CD4049AF
A2U4	1820-0579	9	1	IC MV TTL MONOSTBL RETRIG DUAL	01295	SN74123N
A2U5	1826-0092	3	2	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A2U6	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A2VR1	1902-0176	6	1	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3				P/O A3/A9 AND NOT SEPARATELY REPLACEABLE		
A3/A9	86290-60065	9	1	YTO DRIVER/YTO ASSEMBLIES; REPLACED AS ONE UNIT	28480	86290-60065
	86290-60080	8		RESTORED 86290-60065	28480	86290-60080
A3C1	0160-0127	2	2	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C2	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C3	0160-4084	8	1	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A3C4	0160-4948	3	5	CAPACITOR-FXD .1UF ±20% 50VDC CER	16546	CW20C104MCX (SPECIAL)
A3C5	0160-4948	3		CAPACITOR-FXD .1UF ±20% 50VDC CER	16546	CW20C104MCX (SPECIAL)
A3C6	0160-4948	3		CAPACITOR-FXD .1UF ±20% 50VDC CER	16546	CW20C104MCX (SPECIAL)
A3C7	0160-4948	3		CAPACITOR-FXD .1UF ±20% 50VDC CER	16546	CW20C104MCX (SPECIAL)
A3C8	0160-4948	3		CAPACITOR-FXD .1UF ±20% 50VDC CER	16546	CW20C104MCX (SPECIAL)
A3C9	0160-0300	3	1	CAPACITOR-FXD 2700PF ±10% 200VDC POLYE	28480	0160-0300
A3C10	0180-2186	9	1	CAPACITOR-FXD 300UF±20% 30VDC TA	06001	69F455G7
A3C11	0160-3878	6	1	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A3CR1	1901-0033	2	5	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3K1	0490-0916	6	1	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A3MP1	4040-0751	8	2	EXTR-PC BD ORN POLYC .062-BD-THKNS	28480	4040-0751
A3MP2	4040-0751	8		EXTR-PC BD ORN POLYC .062-BD-THKNS	28480	4040-0751
A3MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A3MP4	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A3Q1	1855-0421	3	3	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A3Q2	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A3Q3	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A3Q4	1853-0221	7	2	TRANSISTOR PNP 2N5416 SI TO-5 PD=1W	3L585	2N5416
A3Q5	1853-0221	7		TRANSISTOR PNP 2N5416 SI TO-5 PD=1W	3L585	2N5416
A3Q6	1854-0474	4	1	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A3Q7	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A3Q8	1855-0082	2	6	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3Q9	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3Q10	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3Q11	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3Q12	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3Q13	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A3R1	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A3R2	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A3R3	2100-0636	4	5	RESISTOR-TRMR 1K 10% C SIDE-ADJ 20-TRN	28480	2100-0636
A3R4	2100-0636	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 20-TRN	28480	2100-0636
A3R5	2100-2497	9	3	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	82PR2K
A3R6	2100-2655	1	3	RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	73138	82PR100K
A3R7	2100-0636	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 20-TRN	28480	2100-0636
A3R8	2100-0636	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 20-TRN	28480	2100-0636
A3R9	2100-2497	9		RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	82PR2K
A3R10	2100-2655	1		RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	73138	82PR100K
A3R11	0683-5645	7	1	RESISTOR 560K 5% .25W FC TC=-800/+900	01121	CB5645
A3R12	0698-8489	4		RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A3R13	0698-8485	0	1	RESISTOR 6.69K .1% .1W F TC=0+4	28480	0698-8485
A3R14	0698-6409	4	1	RESISTOR 19.68K .1% .1W F TC=0+4	28480	0698-6409
A3R15	0698-3459	8	1	RESISTOR 383K 1% .125W F TC=0±100	28480	0698-3459
A3R16	0698-8489	4		RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A3R17	0698-8482	7	1	RESISTOR 5.11K .1% .1W F TC=0+4	28480	0698-8482
A3R18	0698-6408	3	1	RESISTOR 9.88K .1% .1W F TC=0+4	28480	0698-6408
A3R19	0698-8494	1	2	RESISTOR 23.3K .1% .1W F TC=0+4	28480	0698-8494

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R35	2100-2031	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	82PR50K
A3R36	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-T0-1211-F
A3R37	0698-8494	1		RESISTOR 23.3K .1% .1W F TC=0+4	28480	0698-8494
A3R38	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A3R39	0698-3455	4	2	RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A3R40	0698-3455	4		RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A3R41	0698-8469	0	1	RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A3R42	0757-0344	0	1	RESISTOR 1M 1% .25W F TC=0+100	24546	C5-1/4-T0-1004-F
A3R43	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A3R44	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A3R45	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A3R46*				*(FACTORY SELECTED PART)		
A3R47*				*(FACTORY SELECTED PART)		
A3R48*				*(FACTORY SELECTED PART)		
A3R49*				*(FACTORY SELECTED PART)		
A3R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A3R51	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A3R52	0698-7265	2	1	RESISTOR 16.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-1622-F
A3R53	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A3R54	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0+100	24546	C3-1/8-T0-1781-F
A3R55	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A3R56	0683-6855	3	1	RESISTOR 6.8M 5% .25W FC TC=-900/+1100	01121	CB6855
A3R57	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A3R58	0757-0159	5	1	RESISTOR 1K 1% .5W F TC=0+100	28480	0757-0159
A3R59*				*(FACTORY SELECTED PART)		
A3R60	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A3R61	0698-7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A3R62	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A3R63	2100-3054	6	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A3R64	0698-7250	5	1	RESISTOR 3.83K 1% .05W F TC=0+100	24546	C3-1/8-T0-3831-F
A3R65	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A3R66	0698-7197	9	1	RESISTOR 23.7 1% .05W F TC=0+100	24546	C3-1/8-T0-23R7-F
A3R67	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A3R68	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A3U1	1826-0261	8	2	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A3U2	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A3U3	1826-0092	3	2	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A3U4	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A3VR1	1902-0692	1	1	DIODE-ZNR 6.3V 1% DO-7 PD=.4W TC=+.001%	28480	1902-0692
A3VR2	1902-0176	6	1	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	**86290-60034**	2	1	**BOARD ASSY, FM**	**28480**	**86290-60034**
A4C1	0180-0374	3	2	CAPACITOR-FXD 10UF+10% 20VDC TA	56289	150D106X9020B2
A4C2	0180-0269	5	1	CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A4C3	0180-0374	3		CAPACITOR-FXD 10UF+10% 20VDC TA	56289	150D106X9020B2
A4C4	0160-2201	7	1	CAPACITOR-FXD 51PF +5% 300VDC MICA	28480	0160-2201
A4C5	0160-4084	8	1	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A4C6	0160-2266	4	1	CAPACITOR-FXD 24PF +5% 500VDC CER 0+30	28480	0160-2266
A4C7	0180-2208	6	1	CAPACITOR-FXD 220UF+10% 10VDC TA	56289	150D227X9010S2
A4C8	0160-0161	4	1	CAPACITOR-FXD .01UF +10% 200VDC POLYE	28480	0160-0161
A4CR1	1901-0033	2	4	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4J1	1250-0836	2	1	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0836
A4K1	0490-0876	7	1	RELAY-REED 1C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0876
A4L1	9140-0096	1	3	INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A4L2	9140-0096	1		INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A4L3	9140-0096	1		INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A4L4	9100-1693	2	1	INDUCTOR RF-CH-MLD 360UH 5% .2DX.45LG	28480	9100-1693
A4MP1	4040-0752	9	2	EXTR-PC BD YEL POLYC .062-BD-THKNS	28480	4040-0752
A4MP2	4040-0752	9		EXTR-PC BD YEL POLYC .062-BD-THKNS	28480	4040-0752
A4MP3	1205-0202	1	1	THERMAL LINK DUAL TO-18-CS	28480	1205-0202
A4MP4	1480-0073	6	4	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A4MP5	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A4Q1	1854-0023	9	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4Q2	1855-0421	3	2	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A4Q3	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4Q4	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A4Q5	1853-0020	4	2	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q6	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4Q7	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q8	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q9	1854-0039	7	1	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L585	2N3053S
A4Q10	1853-0006	6	1	TRANSISTOR PNP 2N3134 SI TO-5 PD=600MW	04713	2N3134
A4R1	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A4R2	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A4R3	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4-1/8-T0-2871-F
A4R4	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A4R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A4R6	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+100	24546	C4-1/8-T0-6811-F
A4R7	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A4R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A4R9*	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A4R10	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-5621-F
A4R11	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A4R12	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R13	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-5621-F
A4R14	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A4R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A4R16	2100-2633	5	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A4R17	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A4R18	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A4R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R20	0698-3430	5	3	RESISTOR 21.5 1% .125W F TC=0+100	03888	PME55-1/8-T0-21R5-F
A4R21	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A4R22	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A4R23	0698-3412	3	1	RESISTOR 3.83K 1% .5W F TC=0+100	28480	0698-3412
A4R24	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R25	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+100	03888	PME55-1/8-T0-21R5-F
A4R26	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A4R27	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-T0-1961-F
A4R28	0698-4473	8	1	RESISTOR 8.06K 1% .125W F TC=0+100	24546	C4-1/8-T0-8061-F
A4R29	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R30	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A4R31	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A4R32	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A4R33	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A4R34	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A4R35	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A4R36	0757-0834	3	1	RESISTOR 5.62K 1% .5W F TC=0+100	28480	0757-0834
A4R37	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0+100	28480	0757-0198
A4R38	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R39	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A4R40	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+100	03888	PME55-1/8-T0-21R5-F
A4R41	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+100	24546	C4-1/8-T0-3831-F
A4R42	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A4R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R45	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A4R46*			1	RESISTOR, FXD FACTORY SELECTED		
A4R47	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A4TP1	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4U1	1826-0218	5	1	IC OP AMP WB TO-99 PKG	3L585	CA3100T

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	**86290-60113**	**8**	**1**	**BOARD ASSY, SWEEP CONTROL**	**28480**	**86290-60113**
A5C1	0160-0127	2	2	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A5C2	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A5CR1	1910-0016	0	4	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A5CR2	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A5CR3	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A5CR4	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A5MP1	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A5MP2	4040-0753	0		EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A5MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A5MP4	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A5Q1	1855-0020	8	5	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q2	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q3	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q4	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q5	1854-0404	0	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q6	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q7	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q8	1855-0423	5	1	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A5Q9	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q10	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q11	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A5Q12	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5R1	2100-0670	6	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A5R2	2100-3755	4	3	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A5R3	2100-3757	6	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A5R4	2100-3755	4		RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A5R5	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A5R6	2100-3755	4		RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A5R7	0683-1065	7	1	RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
A5R8	0698-8476	9	3	RESISTOR 5.315K .1% .1W F TC=0±5	28480	0698-8476
A5R9	0698-8471	4	1	RESISTOR 1.775K .1% .1W F TC=0±5	28480	0698-8471
A5R10	0757-0465	6	7	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R11	0698-8473	6	3	RESISTOR 3.358K .1% .1W F TC=0±5	28480	0698-8473
A5R12	0698-3156	2	6	RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R13	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R14	0698-8472	5	1	RESISTOR 2.653K .1% .1W F TC=0±5	28480	0698-8472
A5R15	0698-8473	6		RESISTOR 3.358K .1% .1W F TC=0±5	28480	0698-8473
A5R16	0698-8474	7	1	RESISTOR 800 .1% .1W F TC=0±5	28480	0698-8474
A5R17	0698-3158	4	4	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R18	0698-3159	5	5	RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A5R19	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R20	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R21	0698-8473	6		RESISTOR 3.358K .1% .1W F TC=0±5	28480	0698-8473
A5R22	0698-8475	8	1	RESISTOR 1.799K .1% .1W F TC=0±5	28480	0698-8475
A5R23	0698-8476	9		RESISTOR 5.315K .1% .1W F TC=0±5	28480	0698-8476
A5R24	0698-8476	9		RESISTOR 5.315K .1% .1W F TC=0±5	28480	0698-8476
A5R25	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A5R26	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A5R27	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R28	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R29	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A5R30	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R31	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R32	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A5R33	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R34	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A5R35	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R36	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A5R37	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A5R38	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A5R39	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0±100	24546	C4-1/8-T0-1211-F
A5R40	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R41	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R42	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A5R43	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R44	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R45	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A5R46	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R47	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R48	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R49	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5S1	3101-1871	4	1	SWITCH-SL 4PDT SUBMIN .3A 125VAC PC	28480	3101-1871
A5TP1	1251-0600	0	6	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP7	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A5TP8	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A5TP9	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A5U1	1826-0261	8	2	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A5U2	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A5U3	1820-0269	4	1	IC GATE TTL NAND QUAD 2-INP	01295	SN7403N
A5U4	1820-1543	9	1	IC BFR CMOS NON-INV HEX 1-INP	3L585	CD4050AF
A5U5	1820-1124	2	1	IC BFR TTL NOR QUAD 2-INP	01295	SN7433N
A5VR1	1902-3182	0	1	DIODE-ZNR 12.1V 5% DO-35 PD=.4W	28480	1902-3182
A5VR2	1902-0556	6	1	DIODE-ZNR 20V 5% PD=1W IR=5UA	28480	1902-0556
A5W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	**86290-60084**	**2**	**1**	**BOARD ASSY, STOP SWEEP**	**28480**	**86290-60084**
A6C1	0180-0116	1	3	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C2	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C3	0180-0291	3	1	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A6C4	0160-2204	0	2	CAPACITOR-FXD 100PF ±5% 300VDC MICA	28480	0160-2204
A6C5	0160-2204	0		CAPACITOR-FXD 100PF ±5% 300VDC MICA	28480	0160-2204
A6C6	0160-3491	9	1	CAPACITOR-FXD .47UF ±20% 50VDC CER	28480	0160-3491
A6C7	0180-0197	8	2	CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A6C8	0180-0197	8		CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A6C9	0160-3877	5	1	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A6C10	0180-1745	4	2	CAPACITOR-FXD 1.5UF±10% 20VDC TA	56289	150D155X9020A2
A6C11	0160-0570	9	1	CAPACITOR-FXD 220PF ±20% 100VDC CER	20932	5024EM100RD221M
A6C12	0160-3879	7	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A6C13	0180-1745	4		CAPACITOR-FXD 1.5UF±10% 20VDC TA	56289	150D155X9020A2
A6C14	0180-1746	5	1	CAPACITOR-FXD 15UF±10% 20VDC TA	56289	150D156X9020B2
A6C15	0160-4084	8	2	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C16	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C17	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C18	0180-0100	3	3	CAPACITOR-FXD 4.7UF±10% 35VDC TA	56289	150D475X9035B2
A6C19	0180-0100	3		CAPACITOR-FXD 4.7UF±10% 35VDC TA	56289	150D475X9035B2
A6C20	0180-0100	3		CAPACITOR-FXD 4.7UF±10% 35VDC TA	56289	150D475X9035B2
A6CR1	1901-0025	2	7	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR2	1910-0016	0	2	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A6CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR5	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR7	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR8	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR9	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A6K1	0490-0885	8	1	RELAY-REED 2A 500MA 250VAC 24VDC-COIL	28480	0490-0885
A6L1	9140-0137	1	2	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L3	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A6MP1	4040-0754	1	2	EXTR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
A6MP2	4040-0754	1		EXTR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
A6MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A6MP4	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A6Q1	1854-0404	0	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q2	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q3	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q4	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q5	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q6	1854-0071	7	4	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q7	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6R1	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0±100	24546	C4-1/8-T0-8251-F
A6R2	2100-3123	0	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A6R3	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A6R5	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A6R6	2100-3123	0		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A6R7	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A6R8	0698-7260	7	1	RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A6R9	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A6R10	0698-7267	4	2	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-1962-F
A6R11	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A6R12	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A6R13	0698-7278	7	1	RESISTOR 56.2K 1% .05W F TC=0±100	24546	C3-1/8-T0-5622-F
A6R14	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A6R15	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A6R16	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R17	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A6R18	0698-7284	5	1	RESISTOR 100K 1% .05W F TC=0±100	24546	C3-1/8-T0-1003-F
A6R19	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A6R20	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R22	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A6R23	0757-0288	1	3	RESISTOR 9.09K 1% .125W F TC=0±100	19701	MF4C1/8-T0-9091-F
A6R24	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1212-F
A6R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R26	0757-0470	3	2	RESISTOR 162K 1% .125W F TC=0+100	24546	C4-1/8-T0-1623-F
A6R27	0757-0470	3		RESISTOR 162K 1% .125W F TC=0+100	24546	C4-1/8-T0-1623-F
A6R28	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R29	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+100	24546	C4-1/8-T0-3831-F
A6R30	0698-7274	3	1	RESISTOR 38.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-3832-F
A6R31	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R32	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-7501-F
A6R33	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R34	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A6R35	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A6R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6R37	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A6R38	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A6R39	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A6R40	0698-7243	6	1	RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A6R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6TP1	1251-0600	0	10	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6U1	1820-1423	4	3	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A6U2	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A6U3	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A6U4	1820-0661	0	1	IC GATE TTL OR QUAD 2-INP	01295	SN7432N
A6U5	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U6	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U7	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U8	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	**86290-60114**	9	1	**BOARD ASSY, MOTHER**	**28480**	**86290-60114**
A7CR1	1901-0743	1	4	DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A7CR2	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A7CR3	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A7CR4	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A7J1	1200-0508	0	1	SOCKET, INTEGRATED	28480	1200-0508
A7XA1	1251-0634	0	4	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-0634
A7XA2	1251-2916	5	2	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2916
A7XA3	1251-0634	0		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-0634
A7XA4	1251-0634	0		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-0634
A7XA5	1251-2916	5		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2916
A7XA6	1251-0634	0		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-0634

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	**86290-60010**	**4**	**1**	**BOARD ASSY, LAMP DRIVER**	**28480**	**86290-60010**
A8C1	0160-3879	7	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C2	0180-0197	8	1	CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A8CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR2	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8DS1	2140-0259	1	4	LAMP-INCAND 32 12VDC 60MA T-1-BULB	1F556	32
A8DS1MP1	86290-00034	6	4	CONTACT, LAMP	28480	86290-00034
A8DS1MP2	0361-0457	7	4	EYELET-RLD-FLG .065-OD .125-LG .008-THK	07707	S-5994
A8DS2	2140-0259	1		LAMP-INCAND 32 12VDC 60MA T-1-BULB	1F556	32
A8DS2MP1	86290-00034	6		CONTACT, LAMP	28480	86290-00034
A8DS2MP2	0361-0457	7		EYELET-RLD-FLG .065-OD .125-LG .008-THK	07707	S-5994
A8DS3	2140-0259	1		LAMP-INCAND 32 12VDC 60MA T-1-BULB	1F556	32
A8DS3MP1	86290-00034	6		CONTACT, LAMP	28480	86290-00034
A8DS3MP2	0361-0457	7		EYELET-RLD-FLG .065-OD .125-LG .008-THK	07707	S-5994
A8DS4	2140-0259	1		LAMP-INCAND 32 12VDC 60MA T-1-BULB	1F556	32
A8DS4MP1	86290-00034	6		CONTACT, LAMP	28480	86290-00034
A8DS4MP2	0361-0457	7		EYELET-RLD-FLG .065-OD .125-LG .008-THK	07707	S-5994
A8MP1	0380-0336	1	3	SPACER-RVT-ON .312-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A8MP2	0380-0336	1		SPACER-RVT-ON .312-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A8MP3	0380-0336	1		SPACER-RVT-ON .312-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A8Q1	1854-0071	7	8	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q4	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q6	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q7	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8R1	0698-7275	4	2	RESISTOR 42.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-4222-F
A8R2	0698-7253	8	4	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A8R3	0698-7275	4		RESISTOR 42.2K 1% .05W F TC=0±100	24546	C3-1/8-T0-4222-F
A8R4	0698-7272	1	2	RESISTOR 31.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-3162-F
A8R5	0698-0085	0	4	RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-T0-2611-F
A8R6	0757-0440	7	4	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A8R7	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A8R8	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A8R9	0698-7272	1		RESISTOR 31.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-3162-F
A8R10	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-T0-2611-F
A8R11	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A8R12	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A8R13	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A8R14	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-7501-F
A8R15	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A8R16	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-2152-F
A8R17	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-T0-2611-F
A8R18	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-7501-F
A8R19	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0±100	24546	C4-1/8-T0-178R-F
A8R20	0757-0797	7	1	RESISTOR 90.9 1% .5W F TC=0±100	28480	0757-0797
A8TP1	1251-0600	0	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A8TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A8TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A8U1	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A8U2	1826-0261	8	1	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9				**P/O A3/A9 AND NOT SEPARATELY REPLACEABLE**		
A3/A9	**86290-60065**	**9**	**1**	**YTO DRIVER/YTO ASSEMBLIES; REPLACED AS ONE UNIT**	**28480**	**86290-60065**
	86290-60080	**8**		**RESTORED 86290-60065**	**28480**	**86290-60080**
A9MP1	86290-00010	8	1	BRACKET, HEAT SINK-YIG TUNED OSC.	28480	86290-00010
A9MP2	1250-1143	6	1	NUT-RF CONNECTOR	16179	1707
A10	**5086-7152**	**4**	**1**	**COUPLER-MOD. 2-6.2 GHZ**	**28480**	**5086-7152**
A10MP1	86290-00012	0	1	BRACKET, COUPLER SUPPORT	28480	86290-00012
A10A1	86290-60082	0	1	BOARD ASSEMBLY, YTM BIAS CONTROL	28480	86290-60082
A10A1C1	0160-2253	9	2	CAPACITOR-FXD 6.8PF ±.25PF 500VDC CER	28480	0160-2253
A10A1C2	0160-2306	3	2	CAPACITOR-FXD 27PF ±5% 300VDC MICA	28480	0160-2306
A10A1C3	0160-2253	9		CAPACITOR-FXD 6.8PF ±.25PF 500VDC CER	28480	0160-2253
A10A1C4	0160-2306	3		CAPACITOR-FXD 27PF ±5% 300VDC MICA	28480	0160-2306
A10A1CR1	1901-0518	8	3	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A10A1CR2	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A10A1CR3	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A10A1CR4	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A10A1J1	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A10A1MP1	0380-0322	5	4	SPACER-RVT-ON .062-IN-LG .152-IN-ID	0000	ORDER BY DESCRIPTION
A10A1MP2	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	0000	ORDER BY DESCRIPTION
A10A1MP3	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	0000	ORDER BY DESCRIPTION
A10A1MP4	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	0000	ORDER BY DESCRIPTION
A10A1MP5	1251-3172	7	1	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A10A1Q1	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A10A1Q2	1853-0034	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A10A1Q3	1855-0062	8	1	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A10A1Q4	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A10A1Q5	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A10A1R1	0698-7214	1	1	RESISTOR 121 1% .05W F TC=0+100	24546	C3-1/8-TO-121R-F
A10A1R2	0698-7277	6	6	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R3	0698-7253	8	2	RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A10A1R4	2100-2413	9	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A10A1R5	0698-7260	7	5	RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A10A1R6	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R7	0698-7284	5	1	RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A10A1R8	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A10A1R9	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R10	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-3162-F
A10A1R11	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R12	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R13	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A10A1R14	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A10A1R15	0698-7244	7	1	RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A10A1R16	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A10A1R17	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A10A1R18	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A10A1R19	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A10A1R20	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-2152-F
A10A1TP1	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A10A1U1	1826-0218	5	2	IC OP AMP WB TO-99 PKG	3L585	CA3100T
A10A1U2	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A10A1VR1	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A10A1W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11	**5086-7348**	**4**	**1**	**PWR AMP 2-6.2 GHz**	**28480**	**5086-7348**
A11MP1	5001-6101	3	1	P/O A11 AND NOT SEPARATELY REPLACEABLE	28480	5001-6101
A12	**5086-7272**	**5**	**1**	**YIG TND MLTPLR**	**28480**	**5086-7272**
A12A1				P/O A12 AND NOT SEPARATELY REPLACEABLE		
A12A1C1	0180-2182	5	1	CAPACITOR-FXD 18UF+10% 50VDC TA	56289	150D186X9050R2
A12A1C2	0180-0127	4	1	CAPACITOR-MLTSECT 120/40UF 300V TW-LK	28480	0180-0127
A12A1CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A12A1CR2	1901-0376	6	1	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A12A1J1	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A12A1MP1	0308-0322	3	2	SPACER-RVT-ON .062LG .125ID .250D BRS	28480	0308-0322
A12A1MP2	0308-0322	3		SPACER-RVT-ON .062LG .152ID .250D BRS	28480	0308-0322
A12A1MP3	1251-3172	7	2	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1MP4	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1Q1	1853-0038	4	2	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A12A1Q2	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A12A1R1	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A12A1R2	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0+100	24546	C3-1/8-T0-1471-F
A12A1R3	0698-7273	2	2	RESISTOR 34.8K 1% .05W F TC=0+100	24546	C3-1/8-T0-3482-F
A12A1R4	0698-7284	5	1	RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A12A1R5	0698-7229	8	1	RESISTOR 511 1% .05W F TC=0+100	24546	C3-1/8-TO-511R-F
A12A1R6	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A12A1R7	0698-3102	8	1	RESISTOR 237 1% .5W F TC=0+100	28480	0698-3102
A12A1R8	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A12A1R9	0698-7273	2		RESISTOR 34.8K 1% .05W F TC=0+100	24546	C3-1/8-T0-3482-F
A12A1R10	0683-1555	0	1	RESISTOR 1.5M 5% .25W FC TC=-900/+1100	01121	CB1555
A12A1TP1	1251-0600	0	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1U1	1826-0261	8	1	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A12A1VR1	1902-0176	6	1	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
A12A1VR2	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
AT1	0955-0170	3	1	ATTENUATOR	28480	0955-0170
CR1	86290-60045	0	1	LBHCD DETECTOR	28480	86290-60082
CR2	1901-0050	9	2	D SW 80V .2A LG	28480	1901-0050
CR3	1901-0050	9		D SW 80V .2A LG	28480	1901-0050
DC1	0955-0161	9	1	CPLR 6.5-18 GHz SMA	28480	0955-0161
DS1	1990-0325	2	1	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4403
FL1	9135-0188	1	1	FLTR HP 7.5 GHz SMA	28480	9135-0188
J1	86290-60005	7	3	CONNECTOR ASSY, TYPE N (RF OUT)	28480	86290-60005
J1	86260-60007	3	2	CONNECTOR ASSY, APC-7 (OPT 005) (RF OUT)	28480	86260-60007
J2	1250-0118	3	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J3				NOT ASSIGNED		
J4	1250-0083	1	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J5	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J6	86290-60005	7		CONNECTOR ASSY, TYPE N (RF OUT)	28480	86290-60005
J7	1251-0635	1	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-0635
J8	1251-0633	9	1	CONNECTOR-PC EDGE 20-CONT/ROW 2-ROWS	28480	1251-0633
J9	86290-60005	7		CONNECTOR ASSY, TYPE N (OPT 004) (RF OUT)	28480	86290-60005
J9	86260-60007	3		CONNECTOR ASSY, APC-7 (OPT 004/005) (RF OUT)	28480	86260-60007
J10	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (OPT 004) (ALC EXT INPUT)	28480	1250-0118
P1	1251-0483	7	1	CONNECTOR 36-PIN M MICRO RIBBON	28480	1251-0483
Q1	1854-0080	8	2	TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
Q1M	1200-0043	8	2	INSULATOR-XSTR ALUMINUM	28480	1200-0043
Q1X	1200-0041	6	2	SOCKET-XSTR 2-CONT TO-3 SLDR-EYE	28480	1200-0041
Q2	1854-0080	8		TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
Q2M	1200-0043	8		INSULATOR-XSTR ALUMINUM	28480	1200-0043
Q2X	1200-0041	6		SOCKET-XSTR 2-CONT TO-3 SLDR-EYE	28480	1200-0041
R1	2100-3747	4	1	RESISTOR-VAR PREC WW 1-TRN 5K 3%	28480	2100-3747
R2	2100-1904	1	1	RESISTOR-VAR CONTROL CC 10K 20% LIN	28480	2100-1904
R3	2100-2593	6	1	RESISTOR-VAR CONTROL CC 5K 20% LIN	28480	2100-2593
R4	2100-3832	8	1	RESISTOR-VAR CONTROL CP 25K 20% LIN	01121	70J4G040L253M

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R5	0811-0612	1	2	RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-0612
R6	0811-0612	1		RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-0612
S1	3101-0070	3	1	SWITCH-SL DPDT MINTR .5A 125VAC/DC	28480	3101-0070
S2	3100-3244	7	1	SWITCH-ROTARY 0.812 STRUT CTR SPCG; 3	28480	3100-3244
S3	3101-0903	1	1	SWITCH-SL DP3T MINTR .5A 125VAC/DC	28480	3101-0903
TP1	1251-0600	0	8	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
VR1	1902-0551	1	2	DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
VR2	1902-0551	1		DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
W1	86290-60003	5	1	CABLE ASSY, RF DRIVE	28480	86290-60003
W2	86290-60006	8	1	CABLE ASSY, COAX (GREY)	28480	86290-60006
W3	86290-60007	9		CABLE ASSY, COAX (BLUE)	28480	86290-60007
W4	86290-20021	3	1	CABLE RF YTO-COUPLER	28480	86290-20021
W5	86290-20022	4	1	CABLE RF COUPLER-AUX OUT	28480	86290-20022
W6	86290-20023	5	1	CABLE RF COUPLER-AMPLIFIER	28480	86290-20023
W7	86290-20125	8	1	CABLE RF AMPLIFIER-ATTENUATOR	28480	86290-20125
W8				NOT ASSIGNED		
W9	86290-20028	3	1	CABLE RF YTM COUPLER	28480	86290-20028
W10	86290-20029	1	1	CABLE RF COUPLER-RF OUTPUT	28480	86290-20029
W11	86290-20031	5	1	CABLE RF COUPLER-RF OUTPUT (OPT 004)	28480	86290-20031
				MISCELLANEOUS PARTS		
	86290-00014	2	1	SCALE: 2-6.2	28480	86290-00014
	86290-00015	3		SCALE: 6-12.4	28480	86290-00015
	86290-00040	4		SCALE: 12-18.6	28480	86290-00040
	86290-00041	5		SCALE: 2-18.6	28480	86290-00041
	86290-60020	6	1	BOARD ASSEMBLY: EXTENDER (P/O ACCESSORIES SUPPLIED)	28480	86290-60020
	86290-20032	6	1	CABLE, RF TEST (ACCESSORY SUPPLIED)	28480	86290-20032
	7120-8615	2	1	LBL, A5S1 NORM WARNING	28480	7120-8615

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Code List of Manufacturers

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U.S.A. COMMON	ANY SUPPLIER OF THE U.S.	
00779	AMP INC	HARRISBURG PA	17105
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03877	TRANSITRON ELECTRONIC CORP	WAKEFIELD MA	01880
03888	KDI PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
05574	VIKING INDUSTRIES INC	CHATSWORTH CA	91311
06776	ROBINSON NUGENT INC	NEW ALBANY IN	47150
07716	TRW INC BURLINGTON DIV	BURLINGTON IA	52601
18714	UNITED SHOE MACHINERY CO	CINCINNATI OH	45202
11236	CTS OF BERNE INC	BERNE IN	46711
11237	CTS KEENE INC	PASO ROBLES CA	93446
15636	ELEC-TROL INC	SAUGUS CA	91350
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW CA	94040
16179	OMNI SPECTRA INC	FARMINGTON MI	48024
17856	SILICONIX INC	SANTA CLARA CA	95050
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
2K497	CABLEWAVE SYSTEMS INC	NORTH HAVEN CT	06473
22753	U I D ELECTRONICS CORP	HOLLYWOOD FL	33021
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71450	CTS CORP	ELKHART IN	46514
71744	CHICAGO MINIATURE/DRAKE	CHICAGO IL	60640
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPUT DIV	FULLERTON CA	92634
76530	TRW ELEK CMPNT CINCH-MONADNOCK DIV	CITY OF INDUSTRY CA	91747
79727	C-W INDUSTRIES	WARMINSTER PA	18974
90949	AMPHENOL SALES DIV OF BUNKER-RAMO	HAZELWOOD MO	63042
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
99800	AMER PRCN IND INC DELEVAN DIV	AURORA NY	14052

SECTION VII
MANUAL BACKDATING CHANGES

7-1. INTRODUCTION

7-2. This manual has been written for and applies directly to instruments with serial numbers prefixed as indicated on the title page. Earlier versions of the instrument (serial number prefixes lower than the one indicated on the title page) may be slightly different in design or appearance. The purpose of this section of the manual is to document these differences, With the information provided in this section, this manual can be corrected so that it applies to any earlier version or configuration of the instrument. Later versions of the instrument (serial number prefixes higher than the one indicated on the title page) are documented in a yellow Manual Changes Supplement.

7-3. To adapt this manual to your instrument, refer to Table 7-1 and make all manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed.

7-4. If your instrument serial number is not listed on the title page of this manual or in Table 7-1, it will be documented in a yellow Manual Changes Supplement. Complimentary copies of this supplement are available through your nearest Hewlett-Packard office. Addresses are provided at the rear of this manual.

NOTE

The intent of this material is for manual correction only, to match the documentation herein with the actual configuration of your instrument. This section is NOT intended as a guide for modifying the instrument.

Table 7-1. Change Index

Serial Number Prefix	Make Manual Change
2217A	A
2138A	A,B
2109A	A,B,C
2046A	A-D
2034A, 2021A	A-E
1952A, 1933A	A-F
1908A, 1904A	A-G
1852A, 1847A	A-H
1840A	A-I
1807A, 1742A	A-J
1737A	A-K
1727A	A-L
1704A	A-M

CHANGE A

Page 3-1, Paragraph 3-7:
Delete the following note:

NOTE

To use the Plug-In in the remote programming mode, a modification to the 8620C should be performed as shown in Service Sheet 5 (Remote Programming).

Page 5-3, Table 5-1:
Change Ref. Des. as follows:
OFFSET ADJ to A5R24
BAND 1 HI to A5R22 (2 places)
BAND 2 B to A5R10
BAND 2 A to A5R13
BAND 3 B to A5R2 (2 places)
BAND 3 A to A5R7

Page 5-9, Paragraph 5-20:
Change the following Ref. Des.:
OFFSET to A5R24
BAND 1 HI to A5R22
BAND 2 B to A5R10
BAND 2 A to A5R13
BAND 3 B to A5R2
BAND 3 A to A5R7

Page 5-9, Paragraph 5-20:
Replace Figure 5-4 with Figure 5-4 of this Manual Backdating.
Change the following Ref. Des.:
Step e, BAND 1 HI to A5R22
Step h, BAND 2 B to A5R10
Step j, BAND 2 A to A5R13
Step n, BAND 3 B to A5R2
Step p, BAND 3 A to A5R7

Page 5-52, Paragraph 5-28:
Replace Figure 5-31 with Figure 5-31 of this Manual Backdating (CHANGE A).
Change BAND 1 HI Ref. Des. in step f to A5R22.
In step o, add BAND 3 B Adj. add Ref. Des. A5R2.

Page 6-30, Table 6-2:
Change A5 Part Number to 86290-60115.
Replace A5 Parts List with attached A5 Parts List (CHANGE A).

Page 6-34, Table 6-2:
Change A7 Part No. to 86290-60057.

CHANGE A (Cont'd)

Page 8-31, SERVICE SHEET 5:
Replace SERVICE SHEET 5 with new SERVICE SHEET 5 of this Manual Backdating (CHANGE A).

Page 8-31, Figures 8-22 and 8-23:
Replace Figures 8-22 and 8-23 with Replacement Figures (CHANGE A).

CHANGE B

Page 6-37, Table 6-2:
Change A11 Part No. to 5086-7271.
Change AT1 to Part No. 0960-0362, Isolator.

Page 6-38, Table 6-2:
Change W7 to 86290-20024, CABLE RF AMPLIFIER-ISOLATOR.
Add W8 86290-20025, CABLE RF ISOLATOR-YTO, 28480, 26290-20025.

Page 8-49, Figure 8-44:
Replace Figure 8-44 with Replacement Figure 8-44 (CHANGE B) (attached).

CHANGE C

Page 5-5, Table 5-2:
Delete *A1R88.

Page 6-21, Table 6-2:
Change A1 Part No. to 86290-60051.
Delete A1CR20.
Delete A1CR21.

Page 6-23, Table 6-2:
Delete A1R88.
Change A1VR2 to 1902-0025, DIODE-ZNR 10V 5% DO-7 PD=.4W, 28480, 1902-0025.

Page 8-17, Figure 8-9:
Replace Figure 8-9 with Figure 8-9 in this Manual Backdating.

Page 8-17, Figure 8-10:
Change VR2 and delete CR20, CR21, and R88*, as shown in partial schematic Figure 8-10 in this Manual Backdating.

CHANGE D

Page 6-29, Table 6-2:
Change A4Q8 to 1854-0039, TRANSISTOR NPN SI TO-5 PD=1W, 14713, 2N3053.
Change A4R27 to 0757-0416, RESISTOR 511 1% .125W F TC =0±100, 24546, C4-1/8-TO-51R-F.

Page 8-31, Figure 8-22:
Change Q8 Part No. to 1854-0039.
Change R27 value to 511.
Change R28 value to 2150.
Change TP3 voltage to +0.6V.

CHANGE E

Page 6-30, Table 6-2:
Change A5 Part No. to 86290-60055.

CHANGE F

Page 6-30, Table 6-2:
Change A5R5 to 0757-0290, RESISTOR 6.19K 1% .125W F TC=0±100, 19701, MF4C-1/8-TO-6191-F.

Page 6-31, Table 6-2:
Change A5VR1 to 1902-0554, DIODE-ZNR 10.0V 5% DO-7 PD .4W, 04713, SZ 10939-158.

Page 6-37, Table 6-2:
Delete CR2.
Delete CR3.

Page 6-38, Table 6-2:
Delete VR1.
Delete VR2.

Page 6-10, Figure 6-3:
Replace the bottom half of Figure 6-3 with Figure 6-3 of this Manual Backdating.

Page 6-14, Figure 6-4:
Replace the bottom half of Figure 6-4 with Figure 6-4 of this Manual Backdating.

Page 6-17, Figure 6-4:
Delete Item 21.
Delete Item 22.
Delete 23.

Page 8-31, Figure 8-23:
Exchange A5R5 and A5VR1 (A5VR1 cathode going down).

Page 8-33, Figure 8-24:
Exchange A5R5 and A5VR1 (cathode at +20V junction).
Change A5VR1 value to 10.0V.
Change A5R5 value to 6190.

Page 8-38, Figure 8-29.
Replace Figure 8-29 with Figure 8-29 of this Manual Backdating.

Page 8-39, Figure 8-31:
Delete CR2.
Delete CR3.
Delete VR1.
Delete VR2.
(As shown in partial schematic in Figure 8-31 (CHANGE F) of this Manual Backdating.)

Page 8-44, Figure 8-38:
Replace Figure 8-38 with Figure 8-38 of this Manual Backdating.

CHANGE F (Cont'd):

Page 8-45, Figure 8-40:
Delete CR2.
Delete CR3.
Delete VR1.
Delete VR2.
(As shown in partial schematic in Figure 8-40 of this Manual Backdating (CHANGE F).)

CHANGE G

Page 6-24, Table 6-2:
Change A2 to Part No. 86290-60052.

Page 8-17, Figure 8-10:
Change A2 to Part No. 86290-60052.

Page 8-25, Figure 8-17:
Change A2 to Part No. 86290-60052.

CHANGE H

Page 8-25, Figure 8-17:
Change U5A pin 3 and U5B pin 5 connections to HI CUR GND (1).

CHANGE I

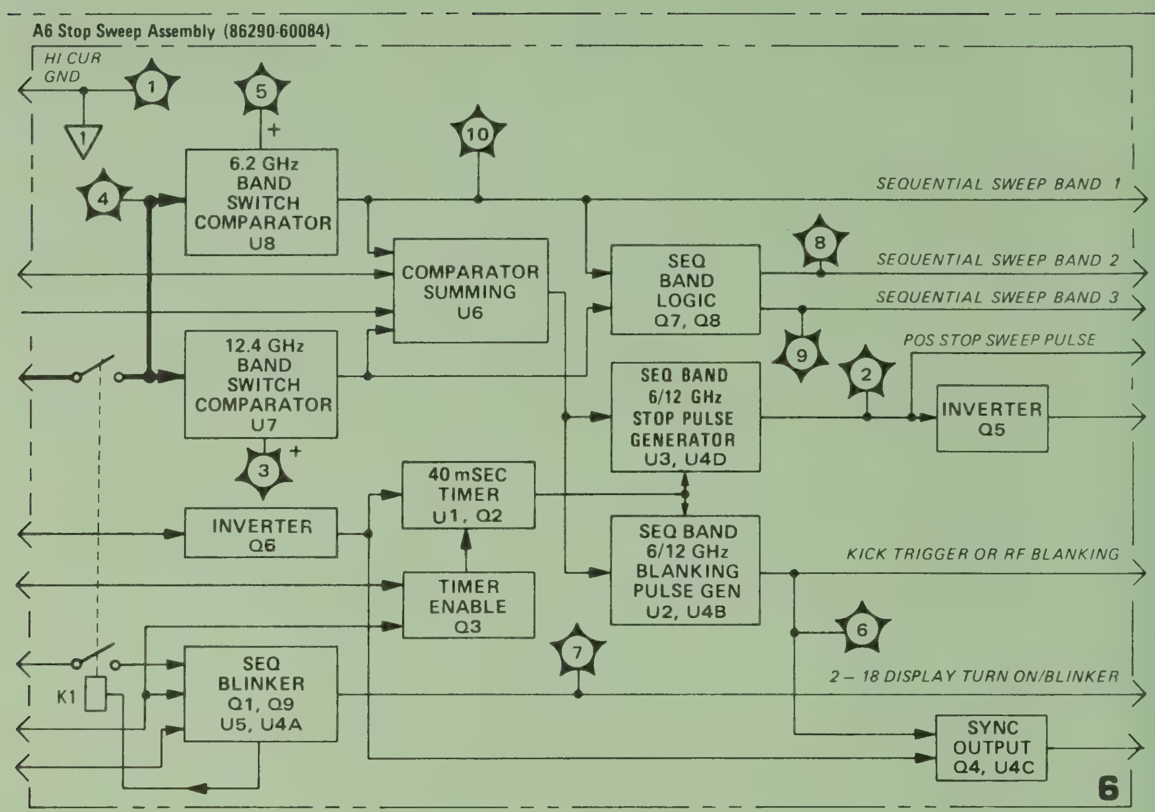
Page 5-12, Paragraph 5-21: (Refer to Manual Backdating Figure 8-25 for test points)
In step e, change A6TP3 to A6TP4.
In step f, change A6TP2 to A6TP1 and A6TP4 to A6TP2.

Page 5-10, Figure 5-5:
Change A6TP4 to A6TP2 and A6TP2 to A6TP1.

Page 6-32 through 6-33, Table 6-2:
Replace A6 portion of Table 6-2 with new (CHANGE I) A6 Replaceable Parts List.

Page 8-34, Table 8-7:
Replace Table 8-7 with Table 8-7 of this Manual Backdating (CHANGE I).

Page 8-9, Figure 8-5:
Change reference designators in A6 Stop Sweep Assembly portion of Troubleshooting Block Diagram in accordance with new reference assignments shown in partial block diagram below.



CHANGE I (Cont'd)

Page 8-35, SERVICE SHEET 6:
Replace SERVICE SHEET 6 with SERVICE SHEET 6 of this Manual Backdating (CHANGE I).

Page 8-33, Figure 8-24:
Replace Figure 8-24 with Figure 8-24 of this Manual Backdating (CHANGE I).

Page 8-35 , Figures 8-25 and 8-26:
Replace Figure 8-25, A6 Stop Sweep Assembly Component Locations diagram, and Figure 8-26, A6 Stop Sweep Assembly Schematic, with new (CHANGE I) Figures 8-25 and 8-26 of this Manual Backdating.

CHANGE J

Page 6-37, Table 6-2:
Change R1 to R1, 2100-2730, RESISTOR-VAR CONTROL C 5K 20%, 11236, 550.

CHANGE K

Page 6-36, Table 6-2:
Delete the following parts on the A10A1 parts entries:
A10A1CR4
A10A1Q1
A10A1Q2
A10A1R17
A10A1R18
A10A1R19
A10A1R20
A10A1VR1
A10A1W1
Change A10A1 HP Part Number to 86290-60050.
Change A10A1Q3 to A10A1Q1.
Change A10A1Q4 to A10A1Q2.
Change A10A1Q5 to A10A1Q3.

Page 8-41, SERVICE SHEET 9:
Replace Figure 8-34 with Figure 8-34 (CHANGE K) of this Manual Backdating.
Replace applicable portion of Figure 18-35 with Figure 8-35 (CHANGE K) of this Manual Backdating.

CHANGE L

Page 6-21, Table 6-2:
Change A1C13* entry to 0140-0197, CAPACITOR FXD 180PF.

Page 6-26, Table 6-2:
Delete A3C11.

Page 6-26, Table 6-2:
Change A3Q4 and A3Q5 HP Part Numbers to 1853-0221.

Page 6-27, Table 6-2:
Change A3R50 entry to A3R50, 0757-1094, RESISTOR 1.47K 1% .125W F TC=0±100, 24546, C4-1/8-TO-1471F.
Change A3R52 entry to A3R52, 0698-7266, RESISTOR 17.8K 1% .05W F TC=0±100, 24546, C4-1/8-TO-1782-G.
Change A3R53 entry to A3R53, 0757-0288, RESISTOR 9.09K 1% .125W F TC=0±100, 24546, MF4-1/8-TO-9091-F.
Change A3R54 entry to A3R54, 0698-7234, RESISTOR 825 1% .05W F C=0±100, 24546 , C3-1/8-TO-825R-G.
Change A3R55 entry to A3R55, 2100-3154, RESISTOR-TRMR 1K 10% C SIDE ADJ 17-TRN, 32997, 3006P-1-102.
Change A3R57 entry to A3R57, 0757-0466, RESISTOR 110K 1% .125W F TC=0±100, 24546, C4-1/8-TO-1103-F.
Change A3R61 entry to A3R61, 0698-7279, RESISTOR 61.9K 1% .05W F TC=0±100, 24546, C3-1/8-TO-6192-G.
Change A2R63 entry to A2R63, 2100-3161, RESISTOR-TRMR, 20K 10% C SIDE ADJ 17-TRN, 32997, 3006P-1-203.
Delete A3R68.

Page 8-21, Figure 8-14:
Change A3C13* value to 180.
Change A1R37 value to 1000.

CHANGE L (Cont'd)

Page 8-25, Figure 8-17:
Delete A2Q7 and A2Q8 part numbers.

Page 8-27, Figure 8-20:
Delete A3R68, between test point 4 and U3A pin 2.
Delete A3C11, between U3A pins 1 and 2.
Change A3R29* and A3R30* to A3R29 and A3R30.
Change A3R50 value to 1.47K
Change A3R57 value to 110K
Change A3R52 value to 17.8K
Change A3R54 value to 825
Change A3R53 value to 9.09K
Change A3R55 value to 1K
Change A3R63 value to 20K
Change A3R61 value to 61.9K

CHANGE M

Page 6-5, Figure 6-1:
Change J1MP1 HP Part Number for first entry of J1MP1 to 1250-0914.

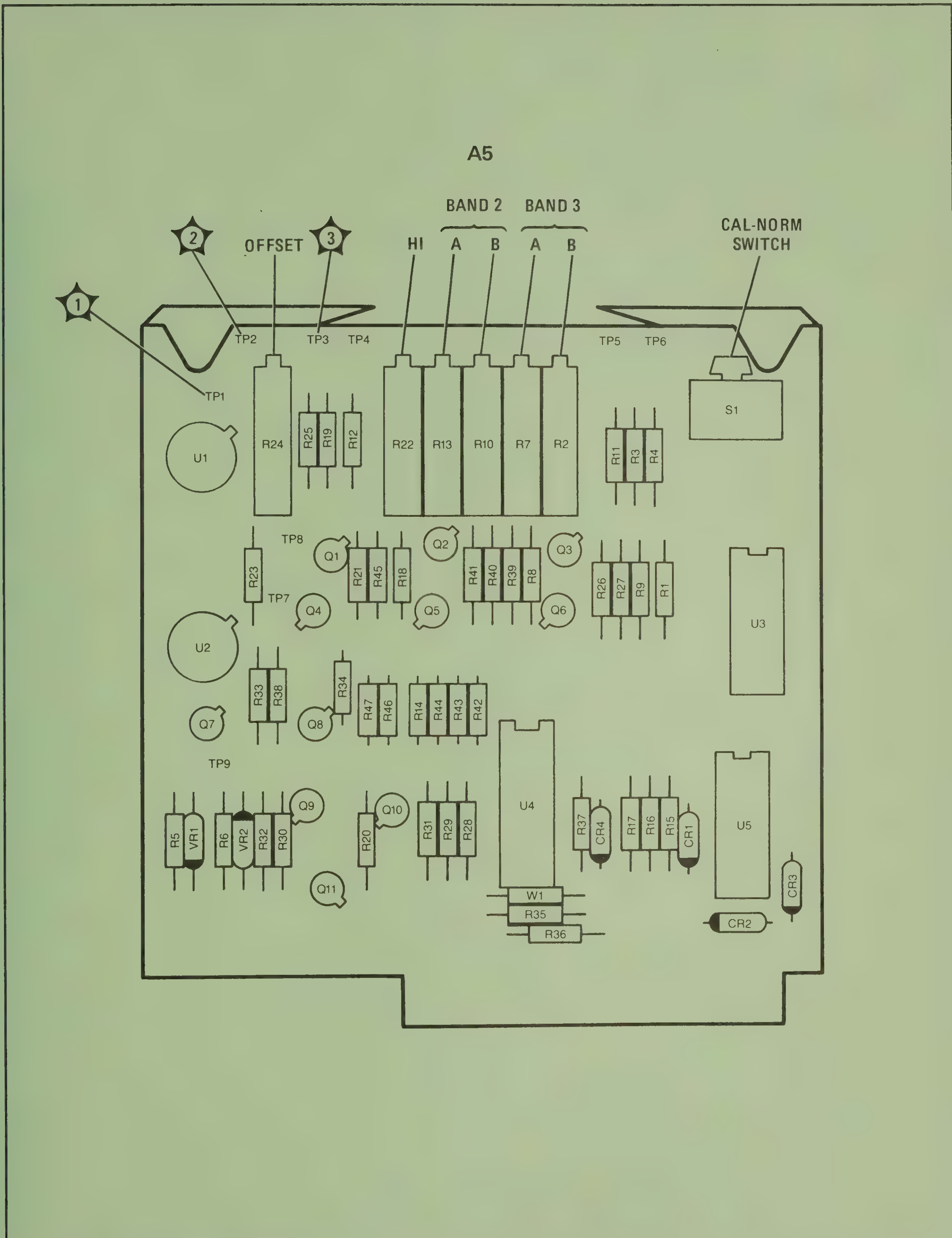


Figure 5-4. Sweep Control Adjustments Location (CHANGE A)

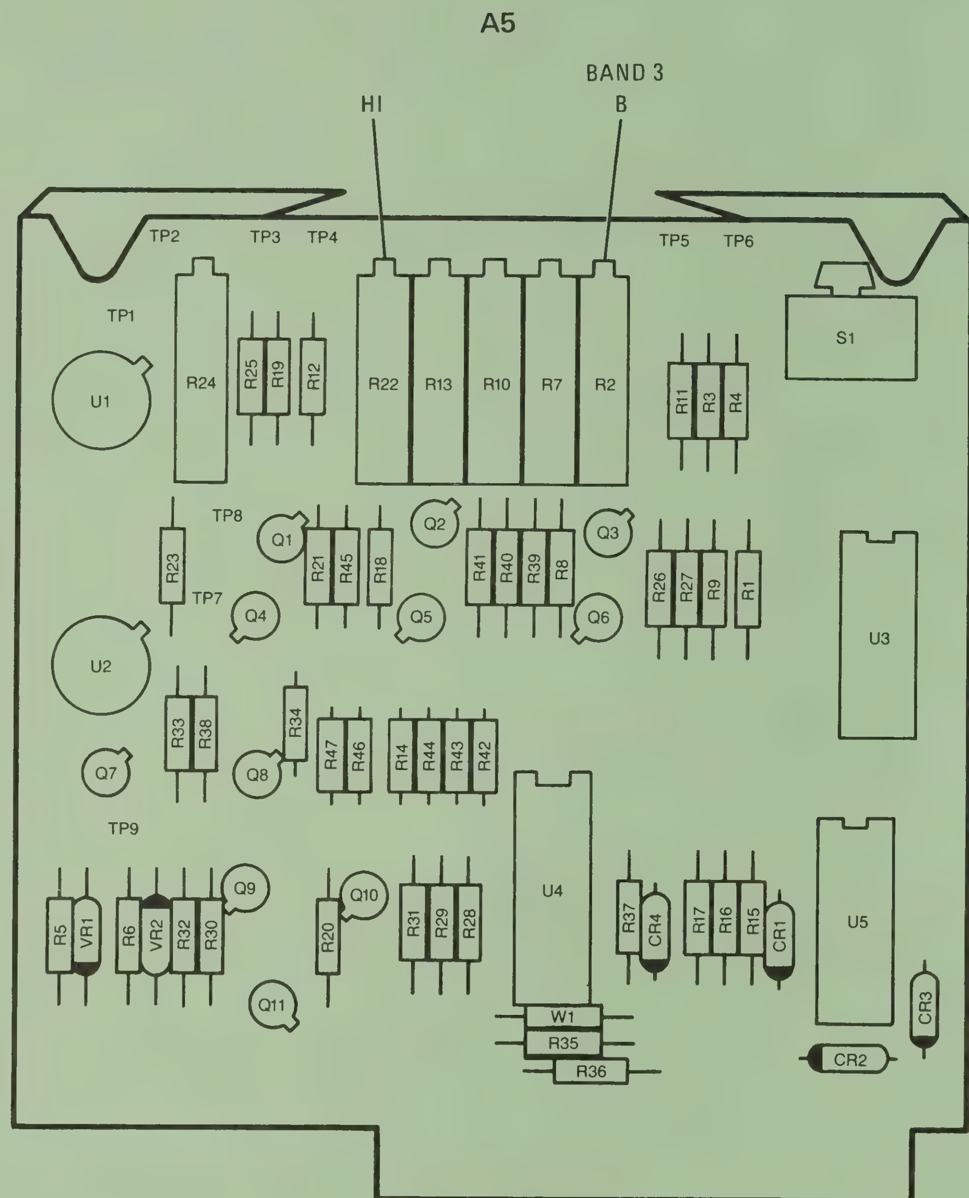


Figure 5-31. Band Sweep Overlap Adjustments Location (CHANGE A)

Table 6-2. Replaceable Parts (CHANGE A)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5	86290-60055	1	BOARD ASSY, SWEEP CONTROL	28480	86290-60055
A5CR1	1910-0016	6	DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A5CR2	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A5CR3	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A5CR4	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A5MP1	4040-0753	2	EXTRACTOR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A5MP2	4040-0753		EXTRACTOR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A5MP3	1480-0073		PIN:DRIVE 0.250" LG	00000	OBD
A5MP4	1480-0073		PIN:DRIVE 0.250" LG	00000	OBD
A5Q1	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q2	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q3	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q4	1854-0404	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q7	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q8	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A5Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q11	1853-0007	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A5R1	0698-8473	3	RESISTOR 3.358K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R2	2100-3314	3	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	32997	3006P-1-500
A5R3	0698-8473		RESISTOR 3.358K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R4	0698-8475	1	RESISTOR 1.799K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R5	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A5R6	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R7	2100-3313	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	32997	3006P-1-101
A5R8	0757-0465	8	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R9	0698-8473		RESISTOR 3.358K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R10	2100-3314		RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	32997	3006P-1-500
A5R11	0698-8474	1	RESISTOR 800 .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R12	0698-8472	1	RESISTOR 2.653K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R13	2100-3313		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	32997	3006P-1-101
A5R14	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R15	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R16	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R17	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R18	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R19	0698-8471	1	RESISTOR 1.775K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R21	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R22	2100-3314		RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	32997	3006P-1-500
A5R23	0683-1065	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A5R24	2100-3103	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-103
A5R25	0698-8476	3	RESISTOR 5.315K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R26	0698-8476		RESISTOR 5.315K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R27	0698-8476		RESISTOR 5.315K .1% .1W F TC=0+-5	07716	MAR5, T-16
A5R28	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R29	0698-3159	5	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R30	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R31	0698-3158	4	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5R32	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R33	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R34	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R35	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R39	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R40	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R41	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5R42	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R43	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R44	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5R45	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5R46	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R47	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5S1	3101-1871	1	SWITCH-SL 4PDT-NS MINTR .3A 125VAC PC	28480	3101-1871
A5TP1	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A5TP2	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A5TP3	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A5TP4	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A5TP5	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600

Table 6-2. Replaceable Parts (CHANGE A)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5TP6	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A5TP7	0360-0124	3	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A5TP8	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A5TP9	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A5U1	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A5U2	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A5U3	1820-0269	1	IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A5U4	1820-1543	1	IC-DIGITAL CD4050AY CMOS HEX 1 NON-INV	02735	CD4050AY
A5U5	1820-1124	1	IC-DIGITAL SN7433N TTL QUAD 2 NOR	01295	SN7433N
A5VR1	1902-3139	1	DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A5VR2	1902-0556	1	DIODE-ZNR 20V 5% DO-15 PD=1W TC=+.073%	28480	1902-0556
A5W1	8159-0005		WIRE 22AWG W PVC 1X22 80C (JUMPER)	28480	8159-0005

SERVICE SHEET 5 (CHANGE A)

A5 SWEEP CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A5 Sweep Control Assembly has two functions. The first is to supply band control signals to the FM, YTO Driver, and YTM Driver Assemblies. These control signals determine which band is ON at any given time. The second function is to condition the tuning voltage to become the Frequency Control Voltage for the YTO and YTM drivers. In each band, whether single or multiband, the drivers require a 0 to 10V frequency control voltage input to sweep each band of frequencies. This is true, for example, whether Band 1 is being swept with only Band 1 selected or whether Band 1 is being swept as the 2 to 6.2 GHz range of the 2 to 18.6 GHz Sequential Band 4. In single band, a single sweep is generated for each 0 to 10V sweep input from the mainframe. However, in Band 4 or Sequential Sweep, there are three 0 to 10V sweep outputs from the A5 Assembly for each 0 to 10V sweep input from the 8620C Sweep Oscillator.

Band Control Gates and Drives

Static band turn-on logic signals are applied to the U5 NOR gates from the mainframe. The other inputs to the NOR gates are the dynamic sequential Band signals from the A6 Assembly. With Band 4 selected, the sequential band logic circuit in the A6 Assembly generates three gates: one for each band. The U5A inputs are HI if Band 1 is selected or if Band 4 is selected and the sweep is sweeping the Band 1 frequency range. The +5 to 0V TTL level change applied to U4C is converted to a +10 to 0V level change and routed to the FM, YTM Driver and YTO Driver Assemblies. This level change ensures turn off of the FET switching on the following assemblies. U5B output is LO with Band 2 selected or with Band 4 selected and the Band 2 range being swept. Similarly, NOR gate U5C and driver U4A are the Band 3 control circuits.

Single Band Operation

When single bands are selected, the tuning voltage input becomes the frequency control voltage. With Bands 1, 2, or 3 selected, Q10 is turned OFF and Q7 is ON. The tuning voltage is routed through Q7 and U2 to the A2 and A3 Assemblies.

The frequency control voltage amplifier U2 is a voltage follower and buffer amplifier stage. The single-band sweep driver Q10 is held OFF when not in Band 4 by the LO output of inverter U5D. At the same time, the HI output from inverter Q11 turns the sequential-band sweep driver Q9 ON. This pulls the gate of Q8 to −20V turning it OFF.

Sequential Sweep (Band 4) Operation

The generation of three 0 to 10V sweeps to obtain the 2.0 to 18.6 GHz sequential output is accomplished as follows. When Band 4 is selected, a HI is applied to buffer inverter U3C. The circuits following cause the single band sweep driver Q10 to turn ON which opens a single band switch Q7; sequential band sweep driver Q9 is OFF and Q8 is allowed to conduct. The sweep input from the 8620C mainframe changes from the single 0-to-10V ramp to a multi-level, interrupted ramp at TP1. The sweep is applied to the noninverting input of U1. U1 is embedded in a feedback circuit and the inverting input tracks closely the signal at A4TP1. Bands 1, 2, and 3 of the sequential sweep are generated as follows.

Sequential Sweep – Band 1

The Band 4 Turn-On line applies a HI sequential sweep enable to the sequential sweep select gates U3D, U3B, and U3A. During the 0 to +2.530V ramp (Band 1 range), the A6 Stop Sweep Assembly generates a HI for Sequential Band 1 (output of A6 Assembly 6 GHz switch point comparator). The output of NAND gate U3D is LO which ensures that FET driver Q4 is OFF. With the gate open and tied to the source through the 100K ohm resistor R21, Q1 will be ON. The other two FET drivers Q5 and Q6 receive a HI from NAND gates U3B and U3A respectively. This turns both drivers ON pulling the gates of Q2 and Q3 to −20V and turning them OFF. (The voltage dividers at the inputs of Q4, 5, and 6 maintain a bias so the transistors are just OFF.) The gain and level shifting resistors switched in with Q1 ON, provide a 0-to-10V ramp output from U1. These resistors are R25, R19, and HI adjust R22. With the input to U1 pin 3 set to +2.530V at TP1, R22 is adjusted for +10.00 at TP2. The frequency control voltage output to the YTO and YTM is the 0 to 10V Band 1 waveform at TP2.

Sequential Sweep – Bands 2 and 3

During Sequential Band 2, Q5 is OFF turning Q2 ON. This provides a new feedback circuit around U1. An offset is introduced through the voltage divider R9, R11, and adjusted by R10 (Band 2 B). The gain is set by R26, R12, and the equivalent impedance of the voltage divider. R13 (Band 2 A) is the gain control and adjusts the high-frequency end of the band. Due to the nature of the feedback scheme, there is some interaction between R10 (Band 2 B) and R13 (Band 2 A).

In Sequential Band 3, Q6 and Q3 provide the control. R2 (Band 3 B) is an offset control and adjusts the high-frequency end of the band. R7 (Band 3 A) adjusts the low end and thus the overlap between the high end of Band 2 and low end of Band 3. R2 (Band 3 B) and R7 (Band 3 A) also interact.

Resistor R23 prevents the saturation of U1 (should Q1, Q2, and Q3 be open simultaneously) by always providing some feedback; however, it is large enough not to effect the operation of the circuit. The OFFSET adjust R24 eliminates the offset voltage common to operational amplifiers. Any offset may drift with temperature changes and affect the tuning voltage or accuracy of the circuit.

Calibration/Normal Switch S1

CAL/NORM switch S1 substitutes the Band TURN ON signal from the mainframe for the sequential band signals from the A6 Assembly. The CAL position is used when aligning the sequential sweep offset and Gain adjustments (U1, Q1-Q3). Without the CAL position, the A6 Assembly would switch bands each time the tuning voltage approached a band edge. By switching to CAL position and selecting Bands 1, 2, or 3 on the mainframe, the operator can set the frequency on the mainframe and adjust the corresponding LO and HI voltage at TP2.

Supply Voltages

The +11.75 volts and −20 volts are not available from the mainframe. These voltages are obtained using breakdown diodes VR1 and VR2. Breakdowndiode VR1, connected to +20V, produces +11.75V and VR2, connected to −40V, produces the −20V. The +11.75V is used as a source voltage for the band control gates and drivers.

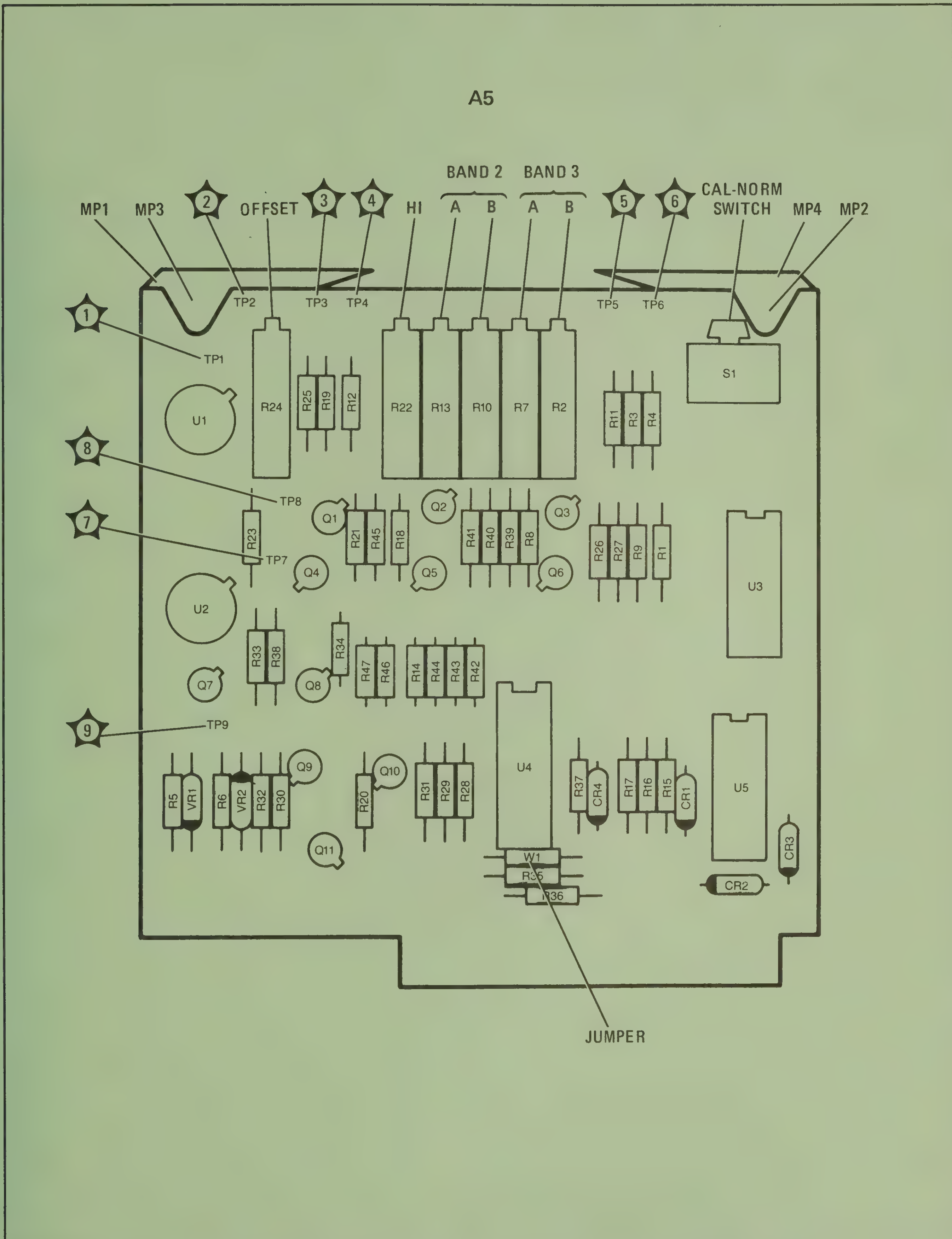
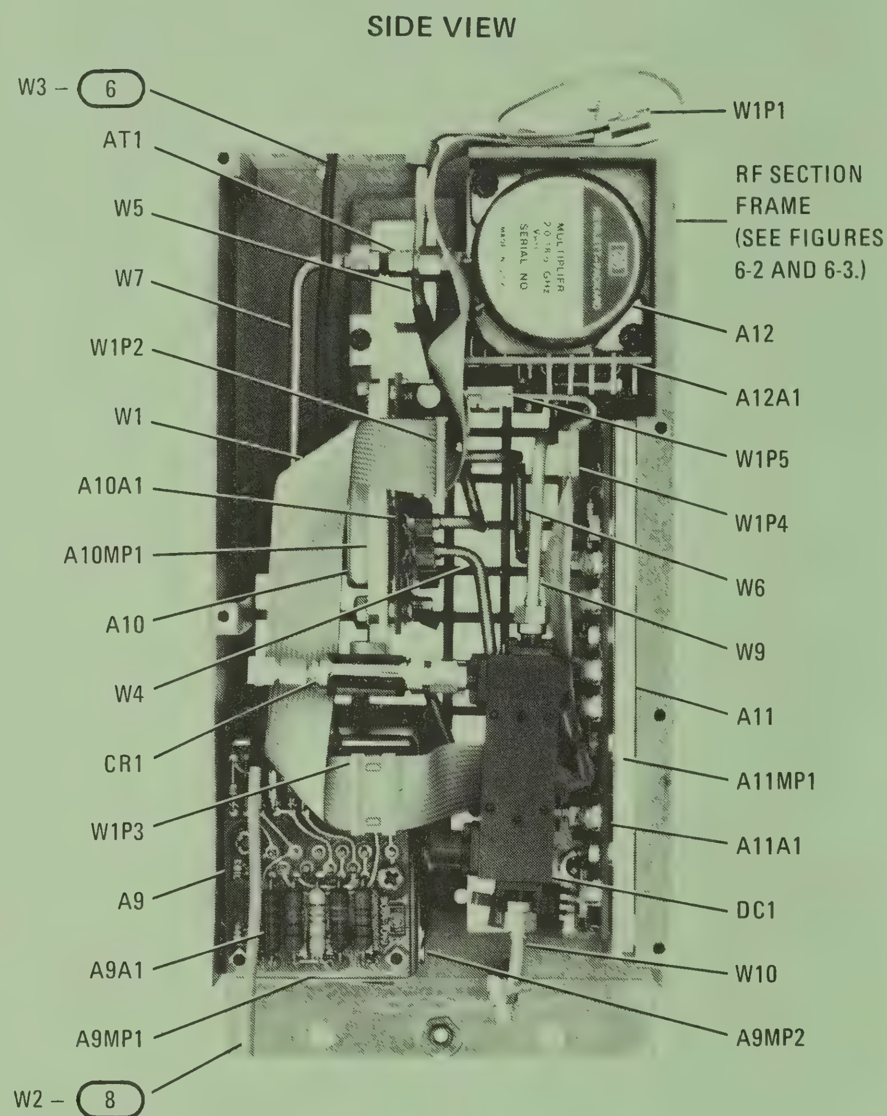


Figure 8-22. A5 Sweep Control Assembly, Component Location (CHANGE A)



Replacement Figure 8-44. RF Section, Major Assembly and Component Location (CHANGE B)

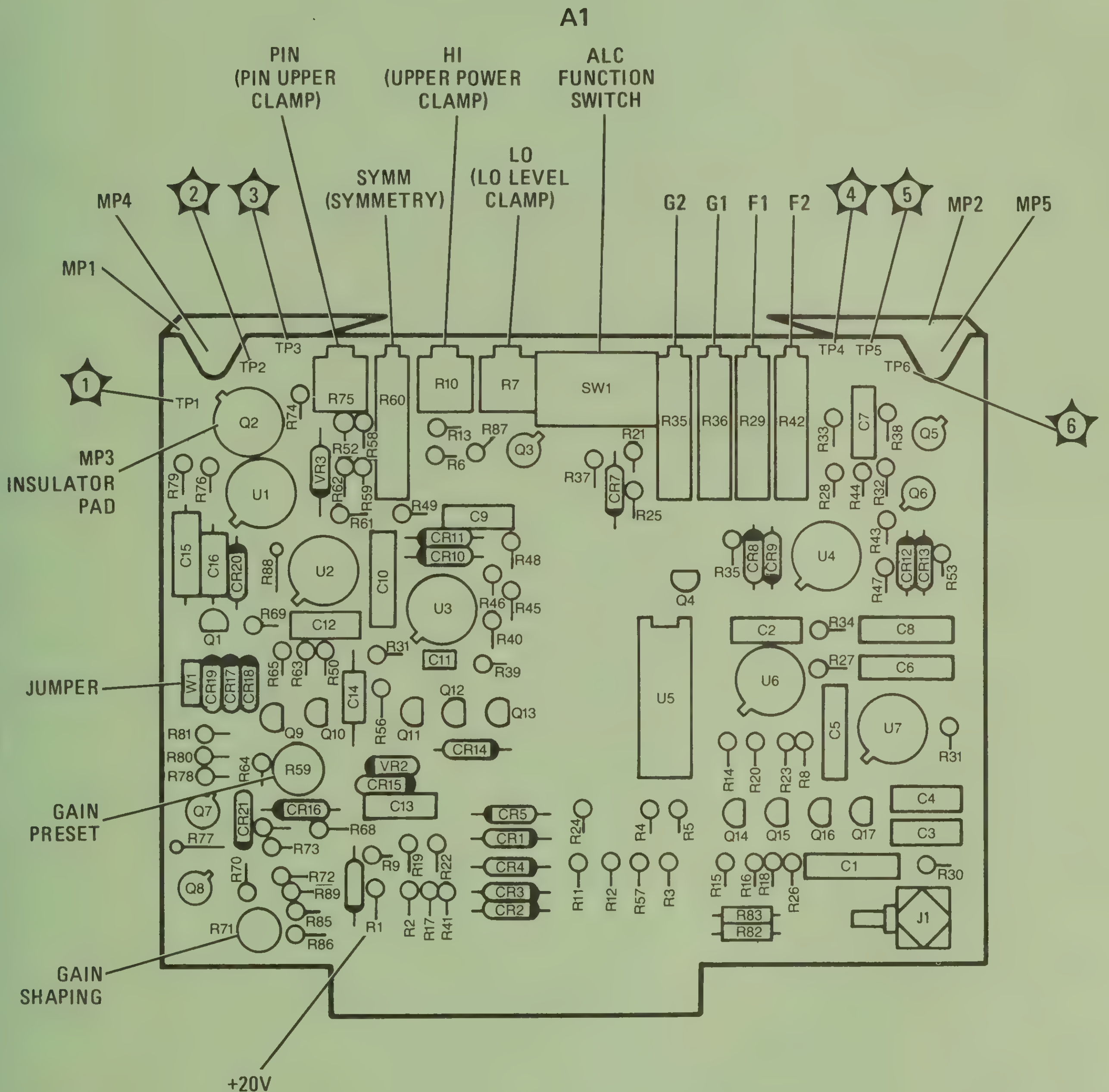


Figure 8-9. A1 ALC Assembly, Component Locations (CHANGE C)

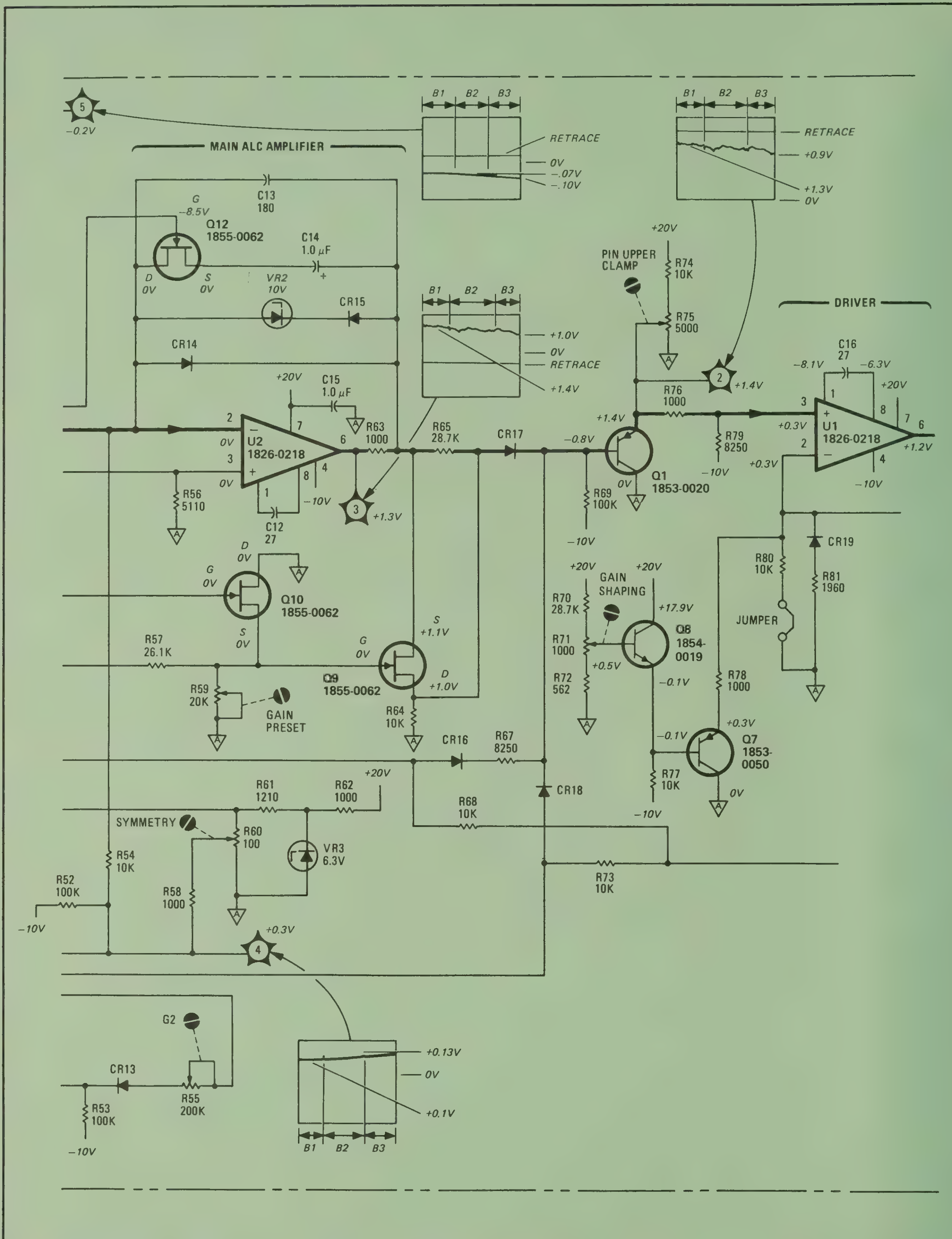


Figure 8-10. P/O A1 ALC Assembly, Schematic (CHANGE C)

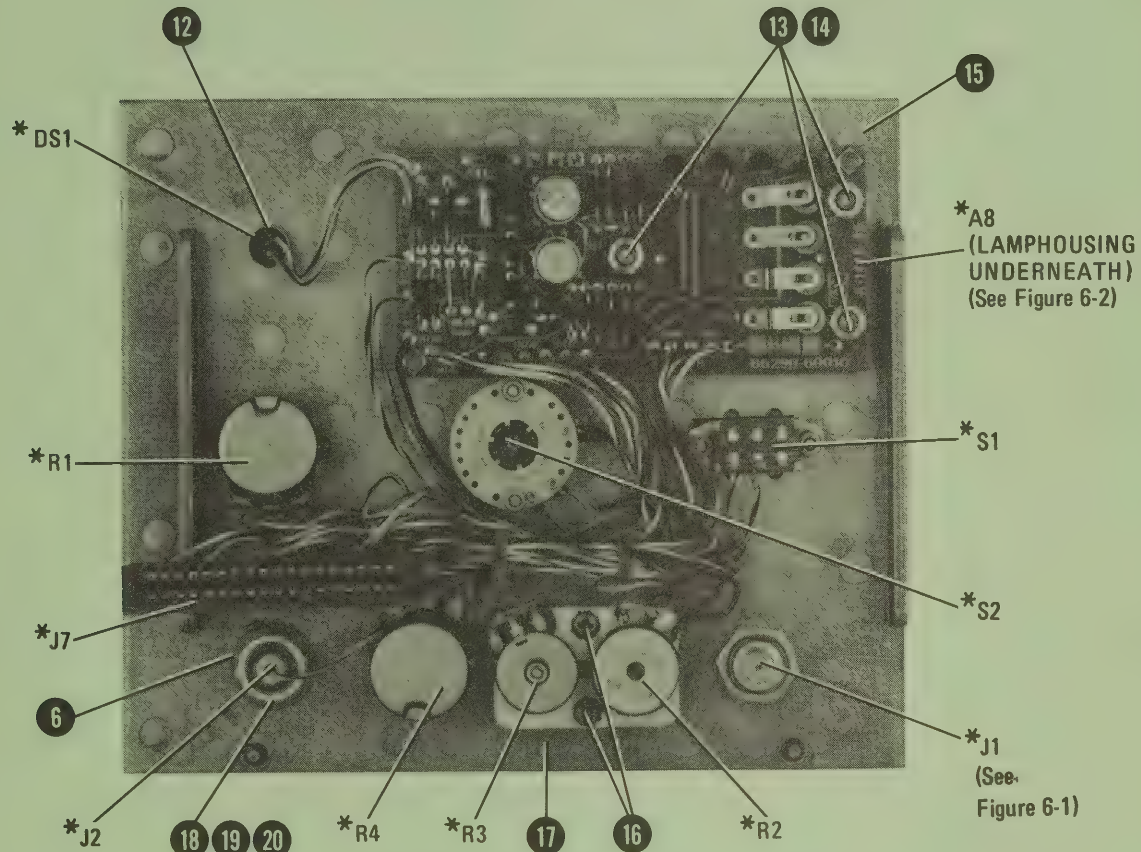


Figure 6-3. Front Panel Parts Identification (CHANGE F)

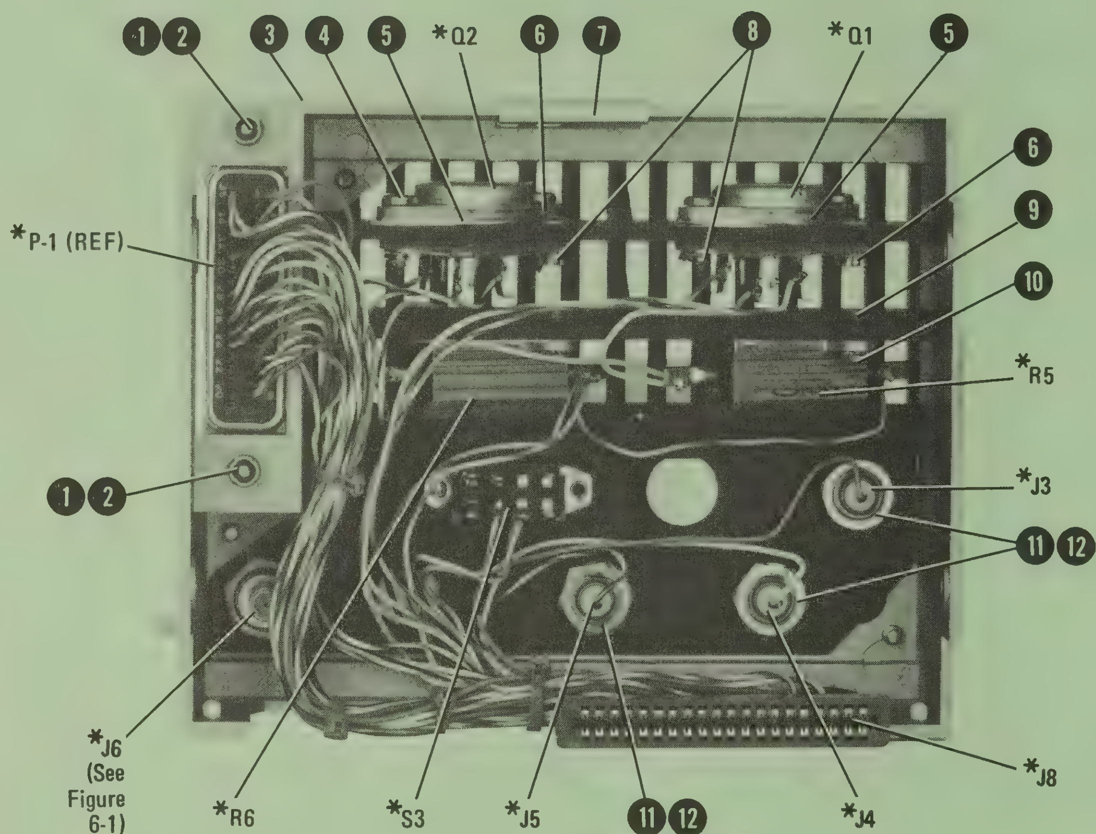
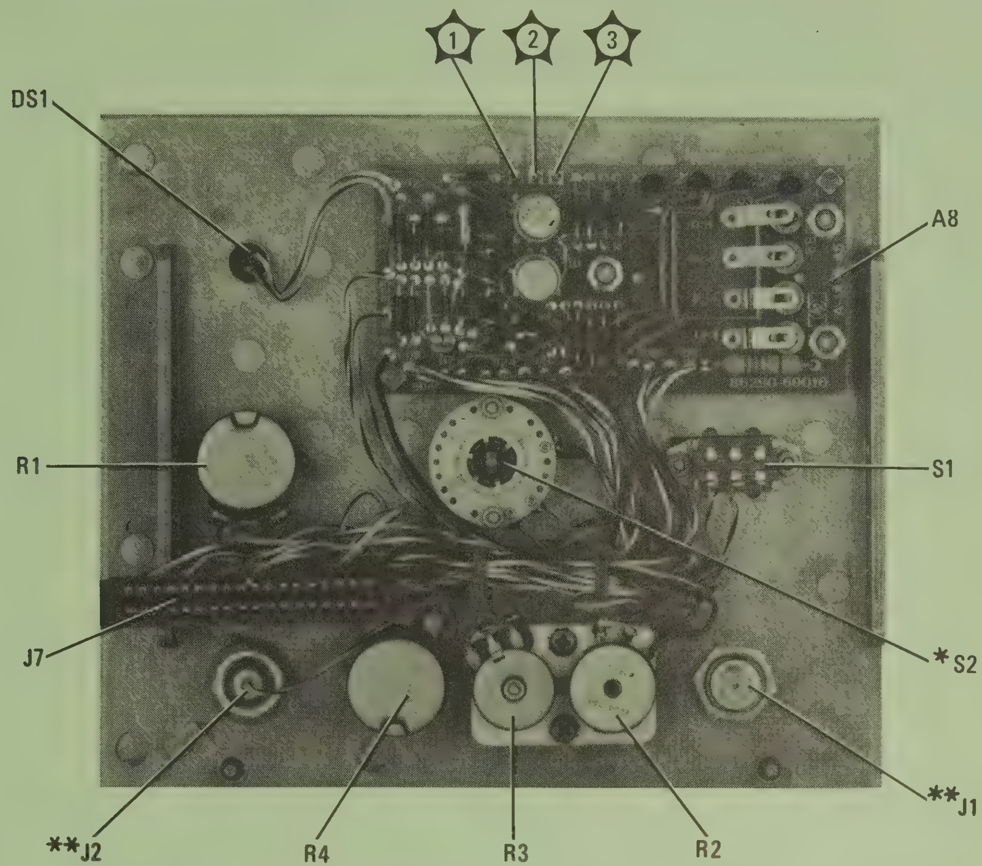


Figure 6-4. Rear Panel Parts Identification (CHANGE F)



* Contact detail of the ALC switch S2 is given in Figure 8-1 near the beginning of this section.

** Connectors J1 and J2 are mounted on rear panel as J9 and J10 for Option 004.

Figure 8-29. Front Panel Component Locations (CHANGE F)

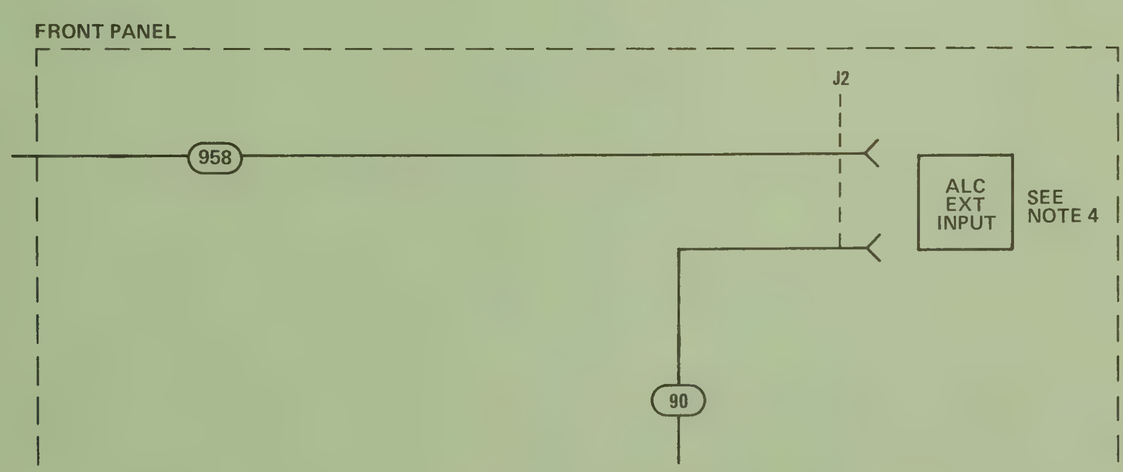


Figure 8-31. Lamp Driver Assembly and Front Panel Schematic (CHANGE F)

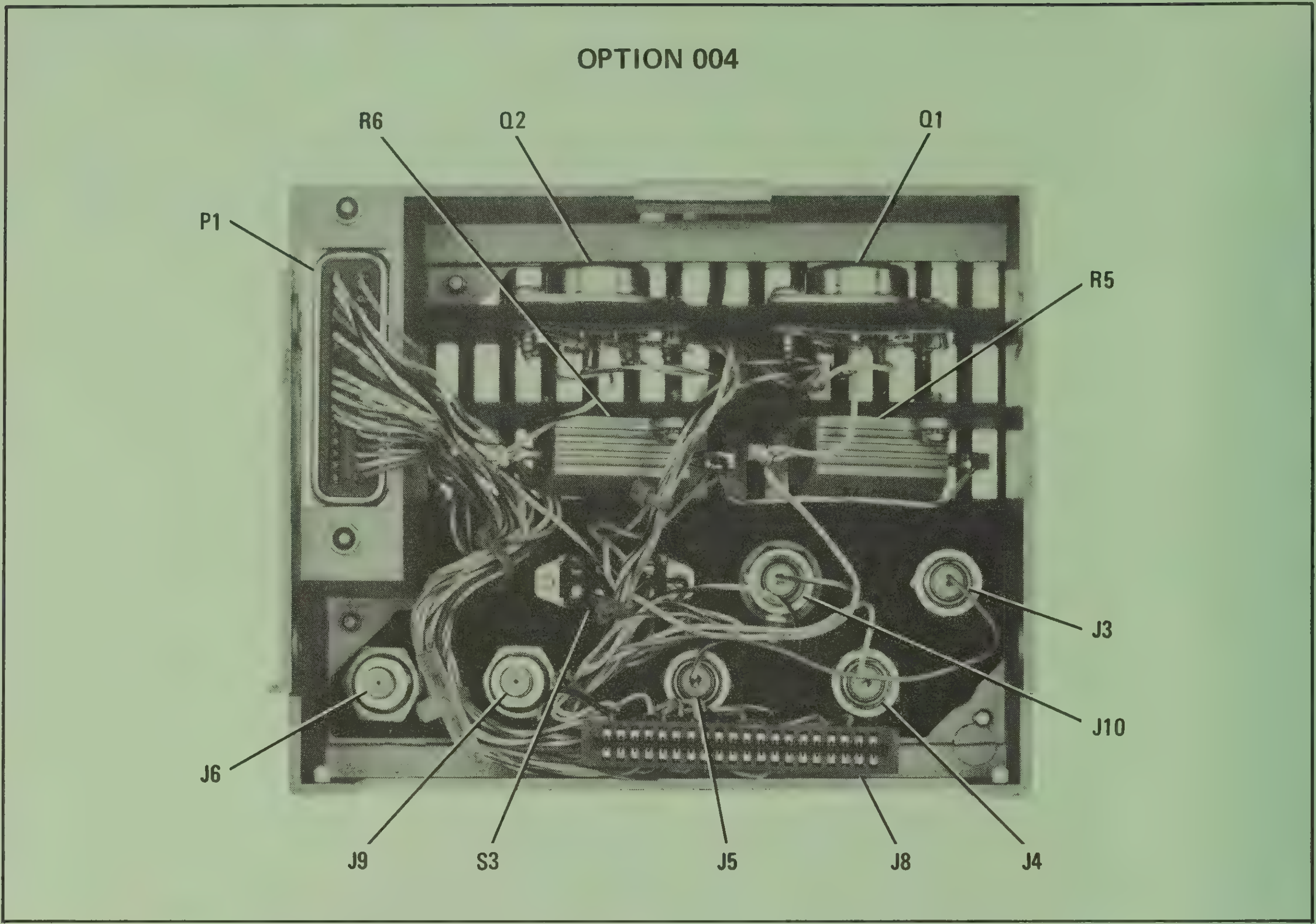


Figure 8-38. Rear Panel Component Location Opt. 004 (CHANGE F)

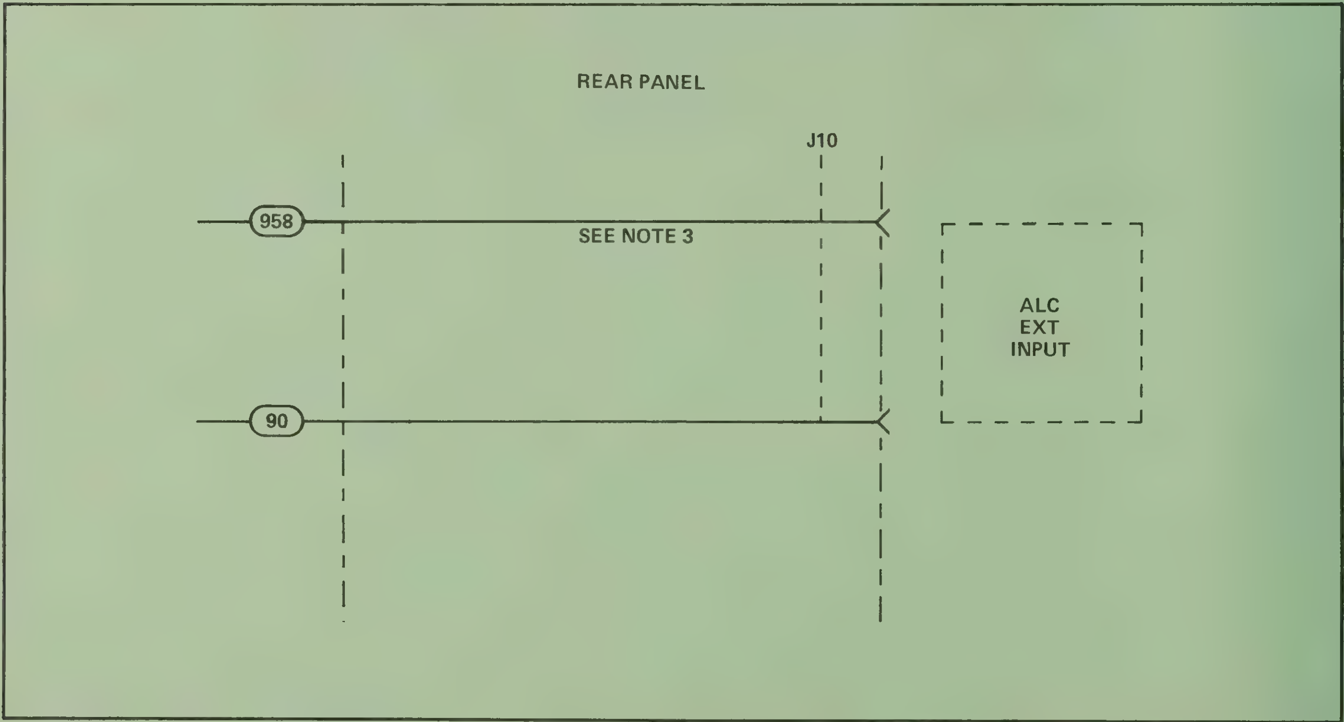


Figure 8-40. Rear Panel Wiring Diagram (CHANGE F)

Table 6-2. Replaceable Parts (CHANGE 1)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6	86290-60016	1	BOARD ASSY, STOP SWEEP	28480	86290-60016
A6C1	0180-0116	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C2	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C3	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A6C4	0160-3448	2	CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A6C5	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A6C6	0160-3491	1	CAPACITOR-FXD .47UF +-20% 50WVDC CER	28480	0160-3491
A6C7	0180-0197	3	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6C9	0160-3877	1	CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A6C10	0180-1745	2	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A6C11	0160-0570	1	CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A6C12	0160-3879	2	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A6C13	0180-1745		CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A6C14	0180-1746	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A6C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A6C16	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A6CR1	1901-0025	7	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR2	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A6CR3	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR4	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR5	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR6	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR7	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR8	1901-0025		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR9	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A6K1	0490-0885	1	RELAY-REED 2A .5A 250V CONT 24V-COIL	15636	R4176-3
A6L1	9140-0137	2	COIL-MLD 1MH 5% Q=60 .19DX.44LG SRF=3MHZ	99800	2500-28
A6L2	9140-0137		COIL-MLD 1MH 5% Q=60 .19DX.44LG SRF=3MHZ	99800	2500-28
A6MP1	4040-0754	2	EXTRACTOR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
A6MP2	4040-0754		EXTRACTOR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
A6MP3	1480-0073		PIN:DRIVE 0.250" LG	00000	OBD
A6MP4	1480-0073		PIN:DRIVE 0.250" LG	00000	OBD
A6Q1	1854-0071	17	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6R1	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A6R2	2100-3123	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	32997	3006P-1-501
A6R3	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R4	0698-3157	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A6R5	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R6	2100-3123		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	32997	3006P-1-501
A6R7	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R9	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A6R10	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A6R11	0757-0470	4	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A6R12	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A6R13	0757-0459	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A6R14	0698-3150	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R15	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R16	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R17	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R18	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R19	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R20	0683-1055	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6R21	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R22	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R23	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R24	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A6R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R26	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A6R27	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A6R28	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R29	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R30	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F

Table 6-2. Replaceable Parts (CHANGE A)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R31	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R32	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A6R33	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R34	0698-7267		RESISTOR 19.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1962-G
A6R35	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A6R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R39	0757-0394	3	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A6R40	0698-7243		RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-G
A6TP1	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP2	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP3	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP4	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP5	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP6	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP7	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP8	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP9	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6TP10	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A6U1	1820-0579		IC-DIGITAL SN74123N TTL DUAL	01295	SN74123N
A6U2	1826-0026	3	IC LM 311 COMPARATOR	27014	LM311H
A6U3	1826-0026		IC LM 311 COMPARATOR	27014	LM311H
A6U4	1820-0579		IC-DIGITAL SN74123N TTL DUAL	01295	SN74123N
A6U5	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A6U6	1820-0661	1	IC-DIGITAL SN7432N TTL QUAD 2 OR	01295	SN7432N
A6U7	1820-0282	1	IC-DIGITAL SN7486N TTL QUAD 2 EXCL-OR	01295	SN7486N
A6U8	1820-0579		IC-DIGITAL SN74123N TTL DUAL	01295	SN74123N
A6VR1	1902-3082	1	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	15818	CD 35610

SERVICE SHEET 6 (CHANGE I)

A6 STOP SWEEP ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The purpose of the A6 Stop Sweep Assembly is to generate control signals for Band 4 Sequential Sweep operation. The control signals include logic signals for control in the plug-in and a stop pulse and sweep speed adjust control for the mainframe. The logic signals provide switching information to the A2 YTM and A3 YTO Drivers, and to the A5 Sweep Control Assembly. The stop pulse occurs at 6.2 GHz and at 12.4 GHz during the 2 to 18.6 GHz sweep. It is applied to the mainframe and causes the sweep oscillator to stop and wait for the YTO and YTM in the plug-in to switch and stabilize in the new RF range. The sweep speed adjust control reduces the Band 4 sweep rate to approximately one-third that of the other bands. The A6 Assembly contains other circuits for control of special conditions in single band and sequential band operation. The 40-msec Timer, together with the comparator and pulse generator circuits, provides a correction pulse that prevents tracking errors when using slow repetition rates. Blanking pulses are generated by the A6 Assembly each time the BAND selector is pressed on the mainframe.

6.2 and 12.4 GHz Switch-Point Comparators and Stop Pulse Generators

When Band 4 is selected, the frequency range from 2 to 18.6 GHz is generated sequentially by a 0V to 10V ramp from the 8620C mainframe. Control signals are required to stop the sweep ramp at two switch-points: 6.2 GHz and 12.4 GHz. By stopping the sweep ramp at the switch points, power and frequency gaps are avoided as the frequency is swept sequentially across three separate ranges.

Also in sequential operation, fast sweep tracking between the YTO and YTM is necessary. To achieve this, the maximum rate of frequency change must be no greater than in single-band operation. Since the 2 to 18.6 GHz range is about three times wider than the other ranges, the maximum sweep rate is reduced by a factor of three when operating sequentially. These two operations are accomplished as follows.

The two switch-point comparators consist of U3 and U2, the LO and HI reference potentiometers R2 and R6, and associated components. When Band 4 is selected, the Band 4 Turn On Line is HI and K1 energizes closing contacts 5 and 6. At the start of a sweep, the inputs at pin 3 of U2 and U3 are LO (0V) and both outputs are HI (+5V). U7C/U7D produces a LO at U7B pin 5. The output of U7B pin 6 is LO. When the sweep voltage at U3 pin 3 is equal to the reference voltage on pin 2 (+2.530V), the sweep is at the 6.2 GHz switch-point and the U3 comparator changes state. The exclusive OR gates U7A and U7B also change states and a low-high transistion is applied to pins 2 and 9 of U4A and U4B respectively (U4 is a monostable multivibrator.) A low-high transition on the B input, when the CLR is HI and the

A input is LO, generates a pulse at 1Q (U4A pin 13). The pulse is 6 msec in duration, as established by C7 and R23, and is applied to the mainframe as a stop-sweep pulse. The leading edge of this pulse marks the point in time that the YTM and YTO begin switching from range 1 to range 2. (The CLR input is HI except during special conditions explained in the 40-msec Timer circuit.) After a 6 msec delay, the sweep input from the mainframe continues to increase. At the 12.4 GHz switch-point, it equals the 6.265V reference voltage on U2 pin 2, and U2 changes state. Again the exclusive OR gates U7A and U7B change states and a high-low transition is applied to U4 pins 2 and 9. With a HI on the B input (U4B pin 10) and the CLR HI, a pulse is generated at Q2 (U4B pin 5) with a high-low transistion input. The duration of the pulse is 8 msec set by C8 and R24. The leading edge of this pulse marks the point in time that the YTM and YTO begin switching from range 2 to range 3. On retrace, U2 and U3 change to HI states as the sweep crosses through 6.265V first and then 2.530V. Although pulses are generated during retrace, they are blanked out in the mainframe and not present on the tuning voltage.

Resistor A6R11 provides feedback to modify the reference voltage at U3 pin 2. It causes the reference voltage to decrease by approximately 320 mV. With the reference voltage at U3 pin 2 less than the sweep voltage at U3 pin 3, the output of U3 will be held LO. If the reference voltage remained unchanged, any voltage drop on the sweep input during the dwell time could cause U3 to oscillate. Similar feedback is provided with A6R12 but the offset voltage is approximately 55 mV. The following test may be used to check R11 and the offset voltage. Select CW Mode and manually set the tuning voltage to zero. Check for +2.530V at A6TP5. Rotate the CW control so the tuning voltage is above 2.530V. The voltage at TP5 should drop to about 2.500V. A6TP4 is used to check R12; as the tuning voltage is adjusted below, then above +6.265V.

The positive 6 msec and 8 msec pulses are summed in OR gate U6A. The output of U6A is applied to the A8 Lamp Driver Assembly to disable the UNLEVELED lamp and is inverted by Q1 and applied to the mainframe as stop sweep pulses. The stop sweep pulses are inverted in the mainframe and used to gate open the path between the current source and the ramp integrator.

Blanking Pulse Generators

The pulse outputs from the blanking pulse generators U8A and U8B provide three functions: 1) The blanking pulses to the A1 ALC Assembly produce maximum drive current into the modulator, the PIN diodes are full ON, and hence no RF Output. The blanking pulses are 4 msec and 6 msec in duration. The pulses are shorter than the stop pulses to ensure the RF is on before the ramp begins sweeping again. 2) The YIG-Tuned Multiplier Assembly requires a leading edge to indicate exactly when band switching occurs. This Kick Trigger generates an error signal in the YTM driver to compensate for YTM delay characteristics. 3) The positive pulses are applied to OR gate U6B and routed to the rear panel SEQ SYNC connector J3. These pulses can be used as a timing signal for external equipment.

The blanking pulse generators U8A and U8B operate exactly as the stop pulse generators U4A and U4B; therefore, a low-high transistion produces a 4 msec pulse from U8A at the 6.2 GHz switch-point, and a high-low transition produces a 6 msec pulse from U8B at the 12.4 GHz switch-point. The pulses are summed in OR gate U6D and provide the three functions described above.

Sync Output

The output from U6B is routed to J3 on the 86290B rear panel and to the mainframe rear panel PROGRAMMING connector. The outputs from U6B are blanking signals used by the HP 8410B Network analyzer. During a low-high transistion the RF is being turned OFF and the 8410B will not try to lock up. However, on the high-low transistion, RF comes ON and the analyzer initiates a search that continues until lock is achieved. One input to U6B is the sequential band blanking pulse occuring at each switch-point. The other input is the retrace blanking signal.

Sequential Band Logic

The Sequential Band Logic circuit initiates logic levels that indicate which band is to be enabled. For example, when the tuning voltage is in range 1 (between 0V and +2.530V), the logic level for Sequential Band 1 is HI. The logic levels for Sequential Bands 2 and 3 are LO. At the 6.2 GHz switch-point, range 2 is initiated: the logic level for Sequential Band 2 is HI and Bands 1 and 3 are LO. At the 12.4 GHz switch-point, range 3 is initiated with Band 3 HI and the other two bands LO. These logic levels are routed to A5 Sweep Control Assembly to generate the Band 1, 2, and 3 frequency control signals. These controls are then applied to the YTO and YTM drivers. The sequential band logic levels are generated as follows.

The Output voltage level of switch-point comparator U3 becomes Sequential Band 1 since the output is HI when the tuning voltage is in range 1 (0V to +2.530V). The output voltage of U2 is LO when the tuning voltage is in range 3 (+6.265V to 10.0V). The output of U2 is inverted by Q8 and the HI output is Sequential Band 3. To obtain the correct logic level for Band 2, a combination of the Band 1 and Band 3 logic is used as follows. The logic levels of Band 1 and Band 3 are applied to OR gate CR6 and CR7. When either input is HI, the input to inverter Q9 is HI. (The combination of CR6/7 and Q9 form a dual-input NOR gate.) When the tuning voltage is 0V the HI from U3 is applied to CR6 so Sequential Band 2 is LO. Sequential Band 2 is generated as the tuning voltage crosses the 6.2 GHz switch point, at which time Band 3 is LO and Band 1 changes to LO. With both CR6 and CR7 cutoff, Q9 is OFF and the output is HI. At the 12.6 GHz switchpoint, Band 3 applies a HI to CR7 turning Q9 ON.

Comparator Summing

During the selection of a new band at the mainframe, the YTO and YTM could cross points where they would track momentarily and cause a burst of power. Therefore, anytime the band lever is depressed on the mainframe, the RF is turned OFF with a blanking pulse generated either by U8A or U8B. Operation is as follows. The Band 1 and Band 3 Turn ON signals are applied to an exclusive OR gate U7C. Anytime a band is changed, there will be level change on one of the two inputs. Since U7C is an exclusive OR, any change at an input will cause the output to change. Assuming normal operation in Band 2, selecting Band 3 would change the Band 3 Turn On input to HI. The logic levels would change so the output of U7B would go LO. A high-low transition generates a 6-msec blanking pulse from U8B. If Band 1 had been selected initially, there would have been a LO output from U7B. A change at the band selector would have caused a low-high transition to generate a 4-msec blanking pulse by U8A. The blanking pulse widths differ in accordance with the different durations used for the stop pulses.

Kick Trigger

The Stop Pulse and Blanking Pulse Generator circuits U4 and U8 have a common connection to the output of U7B pin 6. Anytime a 6 msec stop pulse is generated by U4A, a 4 msec Kick Trigger is generator by U8A. Similarly, pulses occur simultaneously from U4B and U8B. These Kick Triggers are routed to the A2 YTM assembly to be used in the Sequential Compensation Driver circuit. Two different pulse widths are used because the delay compensation required by the YTM differs at the two switchpoints. For example, to regain tracking once it is lost at 12.4 GHz requires more time than at 6.2 GHz. A 4-msec pulse is generated for Band 2 and a 6-msec pulse for Band 3.

40-msec Timer

The YTO and YTM will track normally at fast or standard sweep repetition rates. However, should the time between sweep cycles exceed 40 msec, then the 40-msec Timer and accompanying logic produce a kick trigger to prevent tracking errors. The logic must first indicate when there is a long time between sweeps and then it must enable the right pulse generator. The 40-msec Timer is enabled by either selecting Band 4 or the .1 to .01 second sweep time on the mainframe. These functions apply a HI to the base of Q5 turning it ON and connecting the emitter of Q4 to ground.

Operation of the 40-msec Timer and logic is as follows. The 40-msec Timer monitors the blanking line and starts timing each time there is a high-low transition; that is, each time a sweep-cycle begins. The blanking pulses are routed from the mainframe to inverter Q3. At the collector of Q3, the leading edge of the positive-going pulse is differentiated by C9/R33, inverted by Q4, and a negative pulse is applied to U1A pin 3. At repetition rates less than 40 msec, these pulses reset the U1A monostable to zero time. When the 40-msec Timer is reset in this way, the monostable generates a spike at U1A $\bar{Q}$; however, this spike is bypassd to ground by C15, resulting in the small glitch at U1A $\bar{Q}$ Output. When the time between pulses is greater than 40 msec, the time interval determined by R38 and C14 expires and the $\bar{Q}$ output goes HI. This output will remain HI until the next differentiated pulse arrives at U1 pin 3.

On a new sweep-cycle, sometime after the timer has expired (greater than 48 msec), the high-low transition of the differentiated pulse does not change the state of U1A $\bar{Q}$, since it is already HI. However, on the low-high transition, the U1A timer is reset causing $\bar{Q}$ to go LO. This produces the transition required to trigger the U1B monostable.

The $\bar{Q}$ output at U1B pin 12 is normally HI; it is connected to the CLR inputs of U8 and U4. When a high-low transition occurs at U1B pin 9, a negative pulse is generated at U1B pin 12 with the time duration set by C11 and R36. At the trailing edge of the pulse (the low-high transition), a pulse is generated by either U8A or U8B. The monostable that is in the enabled state will supply the output pulse. U8A and U8B are enabled by the outputs from the switch point comparators and the comparator summer U7B. The condition required for monostable U8A to generate a 4 msec pulse is met when Band 2 is selected or at the 6.2 GHz switch-point in Band 4. The 6 msec pulse from U8B is generated in all other conditions. The operation with Band 2 selected is as follows.

With Band 2 selected and the time between sweeps greater than 40 msec, there is a HI at U8A pin 2 (B input) and at U8B pin 9 (A input). When an external or single trigger is applied, a low-high transition is routed from U1B pin 12 to the CLR inputs of U8A and U8B. A HI on the B input of U8A and a low-high transition on the CLR, generates a positive pulse at the $\bar{Q}$ output. There is no output from U8B since the A input is HI. When Band 3 is selected U8B generates the pulse, since there is a LO at U8B pin 9 when the CLR pulse is applied. Similarly, stop sweep pulses are generated by U4 in Band 4.

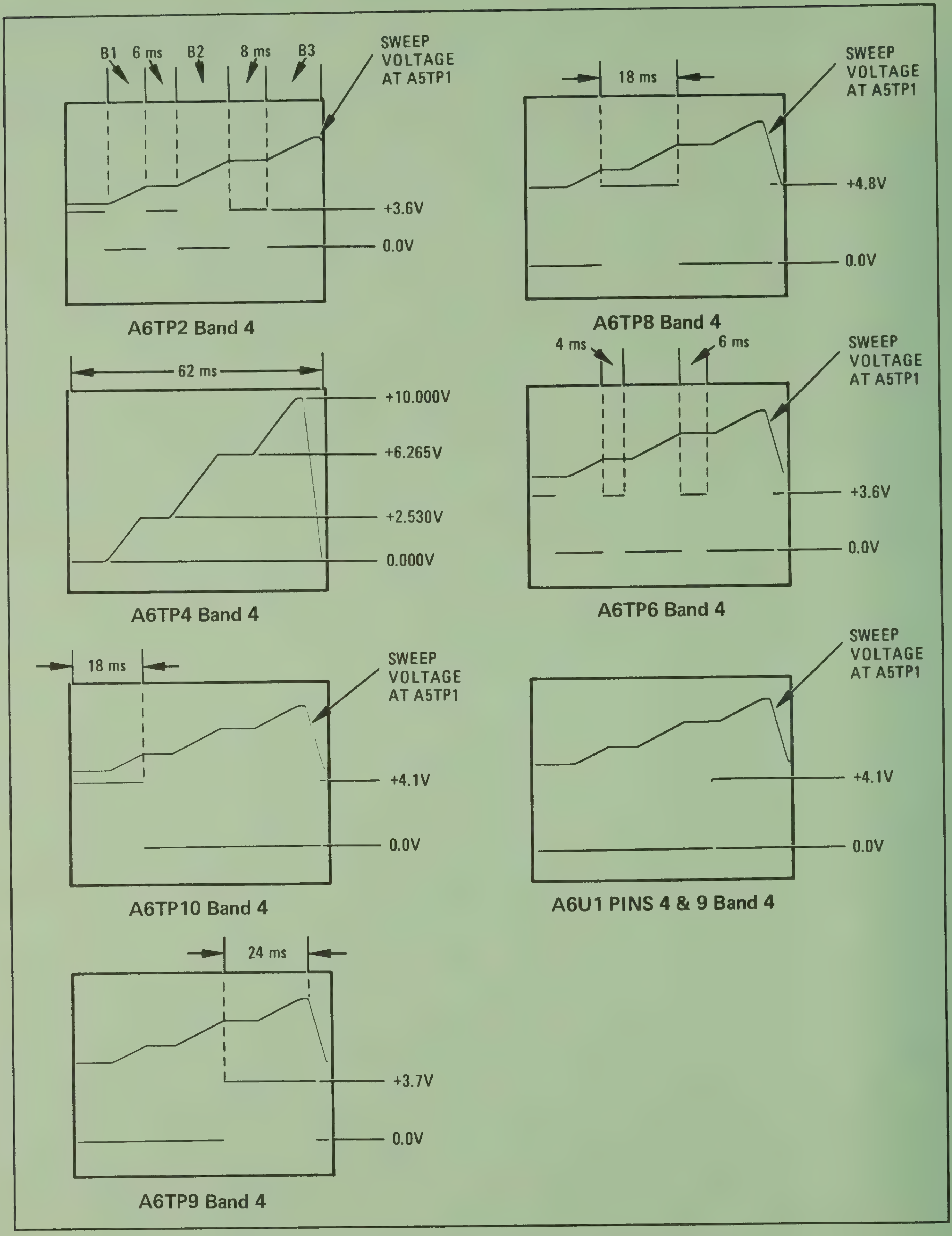


Figure 8-24. A6 Stop Sweep Assembly, Waveforms (CHANGE I)

Table 8-7. Voltages for A6 Stop Sweep Assembly (1 of 3) (CHANGE I)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	+19.7	+19.7	+19.7
TP3	GND REF	GND REF	GND REF
TP4	+ 6.265	+ 6.265	+ 6.265
TP5	+ 2.530	+ 2.530	+ 2.530
TP6	+ 0.2	+ 0.2	+ 0.2
TP7	0	0	0
TP8	0	0	0
TP9	+ 0.1	+ 0.1	+ 0.1
TP10	0	0	0
Q1-E	0	0	0
Q1-B	0	0	0
Q1-C	+ 1.6	+ 1.6	+ 1.6
Q2-E	0	0	0
Q2-B	+ 0.6	+ 0.6	+ 0.6
Q2-C	0	0	0
Q3-E	0	0	0
Q3-B	+ 0.1	+ 0.1	+ 0.1
Q3-C	+ 4.0	+ 4.0	+ 4.0
Q4-E	0	0	0
Q4-B	0	0	0
Q4-C	+ 1.6	+ 1.6	+ 1.6
Q5-E	0	0	0
Q5-B	+ 0.2	+ 0.2	+ 0.2
Q5-C	0	0	0
Q6-E	0	0	0
Q6-B	+ 0.6	+ 0.6	+ 0.6
Q6-C	0	0	0
Q7-E	0	0	0
Q7-B	− 0.3	− 0.3	− 0.3
Q7-C	+19.0	+19.0	+19.0
Q8-E	0	0	0
Q8-B	+ 0.7	+ 0.7	+ 0.7
Q8-C	0	0	0
Q9-E	0	0	0
Q9-B	+ 0.7	+ 0.7	+ 0.7
Q9-C	0	0	0

Table 8-7. Voltages for A6 Stop Sweep Assembly (2 of 3) (CHANGE I)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U1A-3 U1A-4	+ 1.6 + 4.4	+ 1.6 + 4.4	+ 1.6 + 4.4
U1B-9 U1B-12	+ 4.4 + 4.2	+ 4.4 + 4.2	+ 4.4 + 4.2
U2-2 U2-3 U2-7	+ 6.265 +19.7 + 0.2	+ 6.265 +19.7 + 0.2	+ 6.265 +19.7 + 0.2
U3-2 U3-3 U3-7	+ 2.530 +19.7 + 0.2	+ 2.530 +19.7 + 0.2	+ 2.530 +19.7 + 0.2
U4A-2 U4A-3 U4A-13	+ 0.1 + 4.2 + 0.1	+ 3.7 + 4.2 + 0.1	+ 0.1 + 4.2 + 0.1
U4B-5 U4B-9 U4B-11	+ 0.1 + 0.1 + 4.2	+ 0.1 + 3.7 + 4.2	+ 0.1 + 0.1 + 4.2
U5A-1 U5A-2	0 0	0 0	0 0
U5B-5 U5B-6 U5B-7	+15.8 + 0.6 +18.8	+15.8 + 0.6 +18.8	+15.8 + 0.6 +18.8
U6A-1 U6A-2 U6A-3	+ 0.1 + 0.1 0	+ 0.1 + 0.1 0	+ 0.1 + 0.1 0
U6B-4 U6B-5 U6B-6	0 + 0.1 0	0 + 0.1 0	0 + 0.1 0
U6C-8 U6C-9	0 + 0.5	0 + 0.5	0 + 0.5
U6D-11 U6D-12 U6D-13	+ 0.1 + 0.1 + 0.1	+ 0.1 + 0.1 + 0.1	+ 0.1 + 0.1 + 0.1

Table 8-7. Voltages for A6 Stop Sweep Assembly (3 of 3) (CHANGE I)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U7A-1	+ 0.2	+ 0.2	+ 0.2
U7A-2	+ 0.2	+ 0.2	+ 0.2
U7A-3	+ 0.1	+ 0.1	+ 0.1
U7B-4	+ 0.1	+ 0.1	+ 0.1
U7B-5	+ 0.1	+ 0.1	+ 0.1
U7B-6	+ 0.1	+ 3.7	+ 0.1
U7C-8	+ 3.8	+ 0.1	+ 3.8
U7C-9	0	0	+ 3.3
U7C-10	+ 3.3	0	0
U7D-11	+ 0.1	+ 3.8	+ 0.1
U7D-12	+ 3.8	+ 0.1	+ 3.8
U7D-13	+ 1.6	+ 1.6	+ 1.6
U8A-2	+ 0.1	+ 3.7	+ 0.1
U8A-3	+ 4.2	+ 4.2	+ 4.2
U8A-13	+ 0.1	+ 0.1	+ 0.1
U8B-5	+ 0.1	+ 0.1	+ 0.1
U8B-9	+ 0.1	+ 3.7	+ 0.1
U8B-11	+ 4.2	+ 4.2	+ 4.2

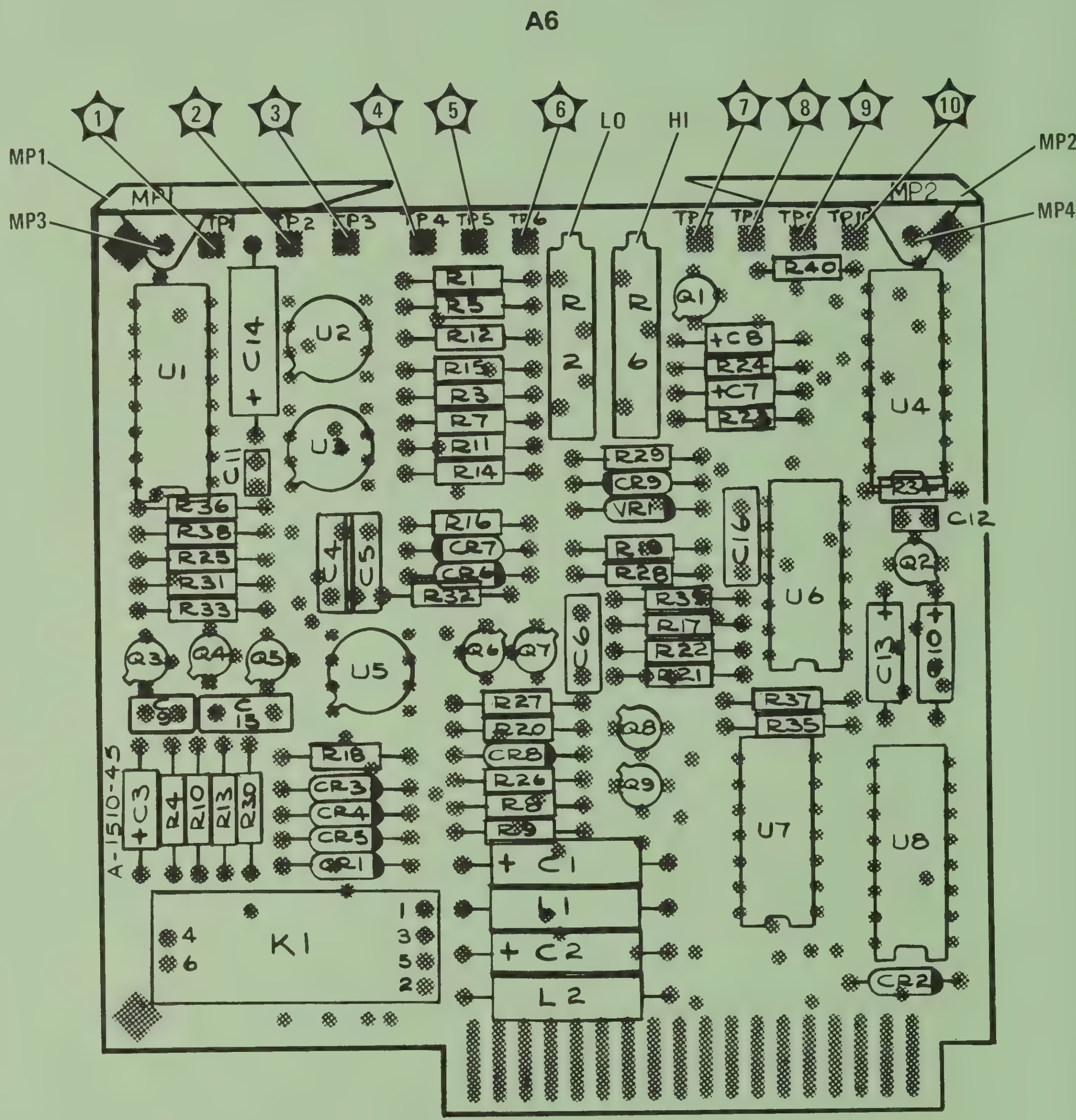


Figure 8-25. A6 Stop Sweep Assembly Component Locations (CHANGE 1)

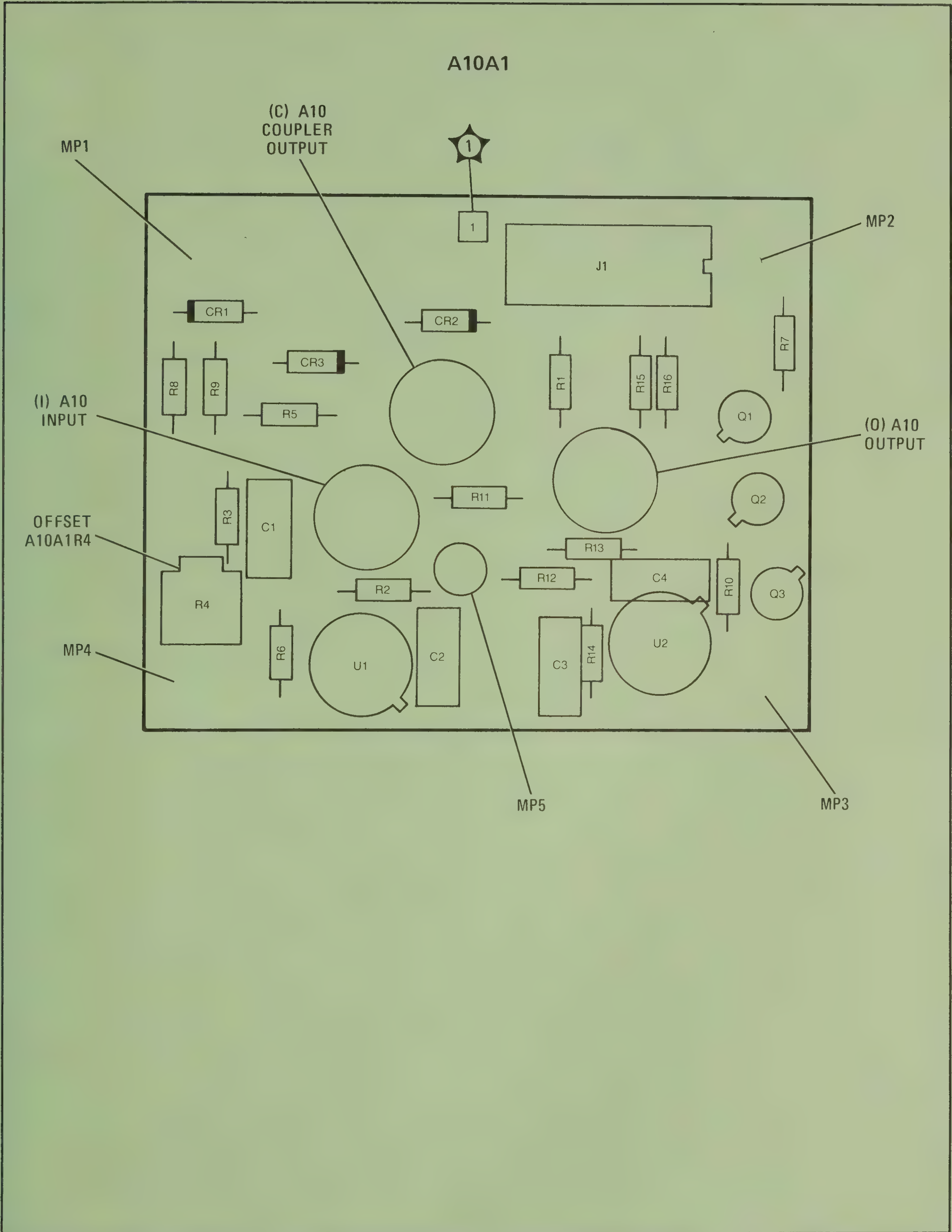


Figure 8-34. A10A1 YTM Bias Control Assembly, Component Locations (CHANGE K)

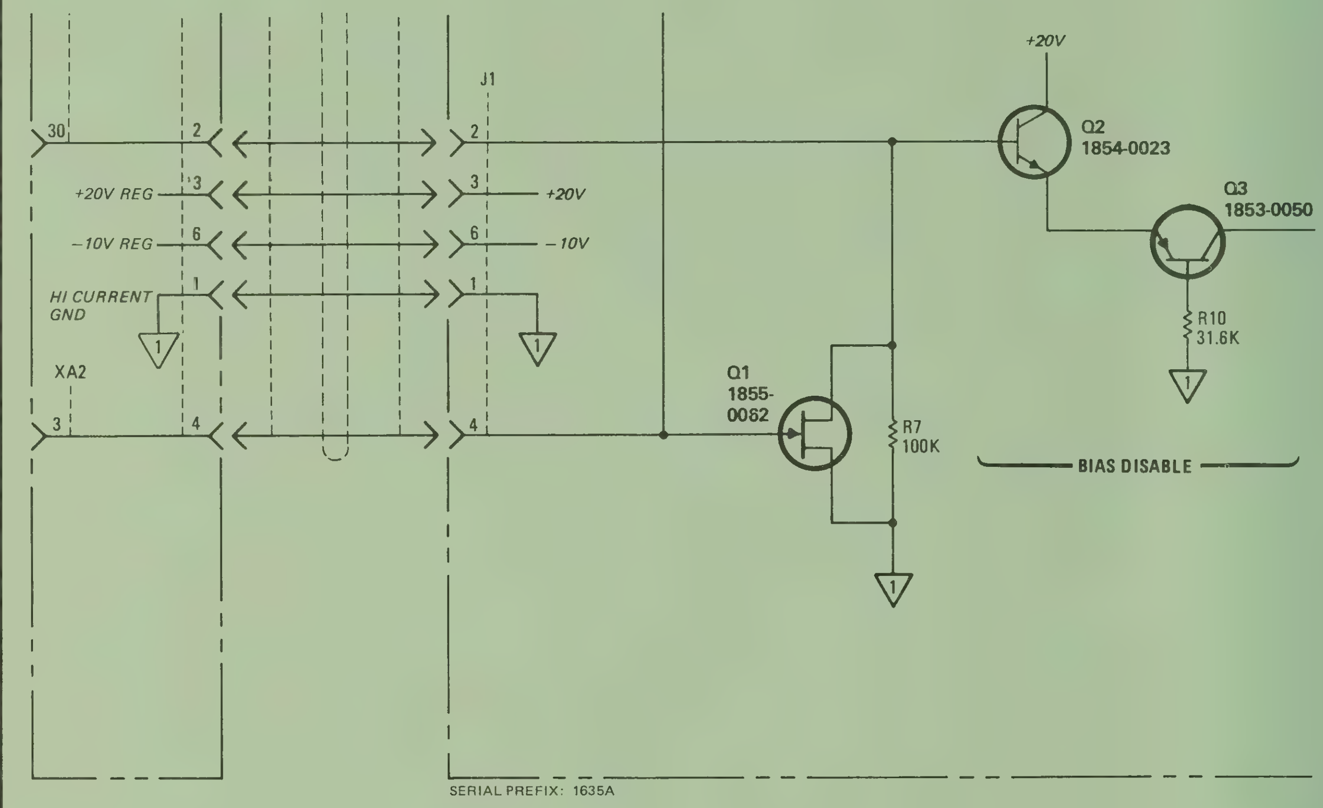


Figure 8-35. A10A1 YTM Bias Control Assembly, Schematic (CHANGE K)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides information for troubleshooting and repairing the Model 86290B RF Plug-In. This information includes timing waveforms, voltages, troubleshooting and functional block diagrams, schematic diagrams, circuit descriptions, and component locations illustrations. Schematic presentations in this manual show electrical circuit operation and are not intended to serve as wiring diagrams.

8-3. ASSEMBLY SERVICE SHEETS

8-4. The schematic diagrams and wiring interconnect diagrams in this section are arranged by service sheets. The service sheet numbers appear in the lower right-hand corner of the schematics (large boldface number above assembly number). Included in each service sheet is the schematic diagram, component location illustration, and circuit description. A list of service sheets cross-referenced to assemblies is given in Table 8-1.

8-5. SAFETY

8-6. The information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. SERVICE AND ADJUSTMENTS SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.

8-7. Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible but, when unavoidable, should be performed only by qualified service personnel who are aware of the hazard involved.

8-8. Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

WARNING

Servicing this instrument often requires working with the instrument's protective covers removed and ac power connected. Extreme caution should be exercised since energy available at many points in the instrument may, if contacted, result in personal injury.

WARNING

BEFORE SWITCHING THE INSTRUMENT ON, ensure that all ac line powered devices connected to the instrument are connected to the protective earth ground.

WARNING

With the ac power cable connected, the ac line voltage (115 or 230 Vac) is present at the terminals of mainframe power line assembly FL1 (mounted on rear panel) and at the mainframe POWER switch, whether the POWER switch is on or off. With the top cover removed, these terminals are exposed and carry ac voltages capable of causing death.

8-9. TROUBLESHOOTING

8-10. Troubleshooting of the 86290B RF Plug-In is accomplished with the use of troubleshooting and functional block diagrams, schematic diagrams, and circuit descriptions. Figures 8-5 and 8-6 are troubleshooting block diagrams for the RF Plug-In and Figure 8-7 is a simpler functional block diagram. Each service sheet contains the schematic diagram, circuit description, and parts location illustration for its designated assembly. Waveforms and dc voltages are included on each schematic diagram. These waveforms and voltages on the schematics are measured in Band 4 (Sequential Band) operation. Waveforms and dc voltages for Bands 1, 2, and 3 are in Figures 8-8, 8-12, 8-16, 8-21, and 8-24 and Tables 8-2 through 8-8. Conditions and control settings used to obtain these waveforms and voltages are given in Figure 8-4.

8-11. There are several assemblies in the 86290B RF Plug-In which are matched with other assemblies, and are not separately replaceable. If one of these assemblies fails, it and the assembly it is matched to must both be replaced. Assemblies that are not separately replaceable include:

1. The A3 YTO Driver Assembly and the A9 YTO Assembly; also the A9A1 is part of the A9 and not separately replaceable.

2. The A11A1 Assembly and the A11 Power Amplifier Assembly.

3. The A12A1 YTM Heater Control Assembly and the A12YTM Assembly.

These assemblies which are not separately replaceable are noted in the replaceable parts list in Section VI of this manual.

8-12. The +5V Regulator, U1, on the A11A1 Assembly may be replaced in the event of failure. However, no further repair of the A11A1 Assembly should be attempted. Schematic diagram of the A12A1 Assembly is provided only as an aid in troubleshooting. It is not intended to serve as a repair aid for the A12A1 Assembly. If the A12A1 assembly is found to be defective, it should be replaced with its parent assembly A12 as noted in Paragraph 8-11 and in the Replaceable Parts List in Section VI.

8-13. RECOMMENDED TEST EQUIPMENT

8-14. Test equipment and accessories required to maintain the Model 86290B are listed in Table 1-4. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-15. REPAIR

8-16. Band Indicator Lamp Replacement

8-17. The procedure for replacing Band Indicator Lamps A8DS1-DS4 is described in Figure 3-13 as Operator's Maintenance.

8-18. Cleaning Switches

8-19. The cleaning agent to be used on the switches is isopropyl alcohol, HP Part No. 8600-0755. Spray the alcohol into the switch and slide or rotate the switch back and forth. Repeat this procedure until the alcohol is evaporated.

8-20. ALC Switch Contact Detail

8-21. For the use as a service aid in troubleshooting, Figure 8-1 shows the contacts for the ALC switch S2.

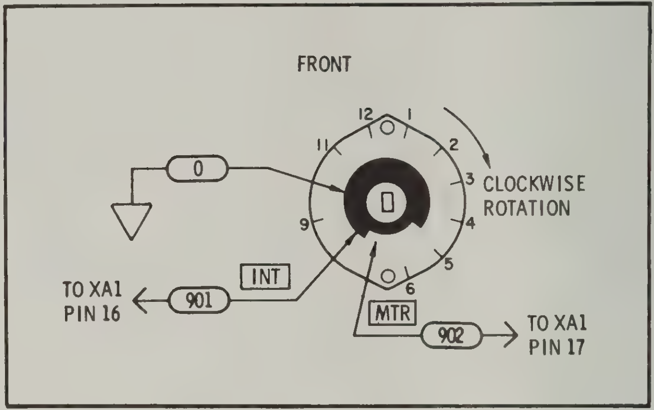


Figure 8-1. ALC Switch S2 Contact Detail

8-22. Unleveled Lamp Removal and Replacement

8-23. The procedure for replacing the UNLEVELED lamp DS1 is described in Figure 8-2. Use the following procedure to test the UNLEVELED lamp:

a. Connect DS1 cathode (short lead) to ground.

b. Connect a 178-ohm resistor between DS1 anode and +5V; if the lamp is good, it should light.

NOTE

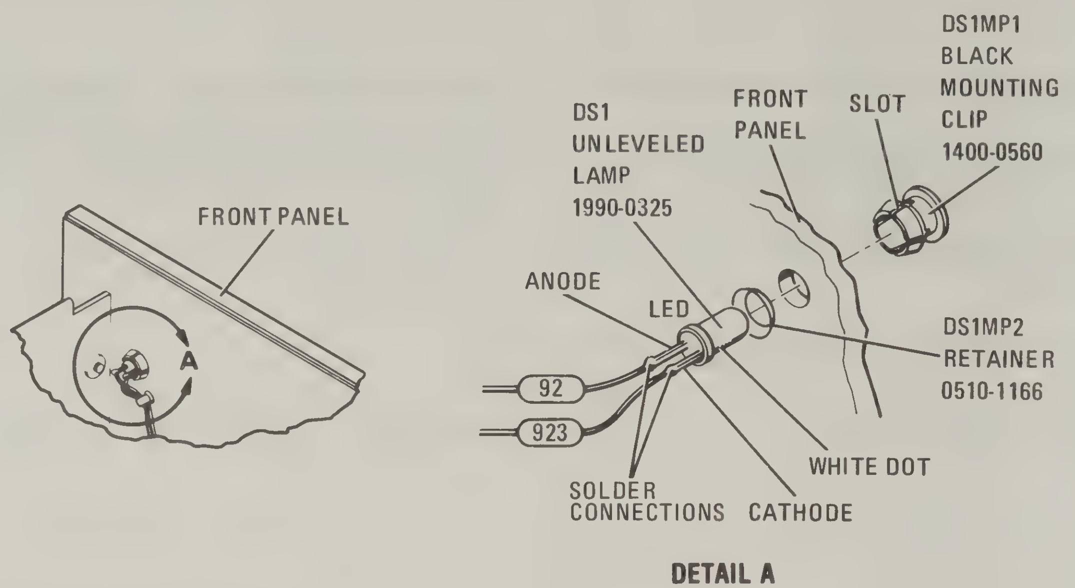
Be sure to use the 178-ohm resistor as the diode current must be limited to 30 ma to prevent damaging a good LED.

8-24. RF Section Removal and Installation

8-25. Removal and installation of the 86290B RF Section is shown and described in Figure 8-42.

8-26. Parts Locations, Test Points, and Adjustments

8-27. Figures 8-43 through 8-47 provide information and illustrations to aid in locating and identifying major assemblies and components for service and repair. Locations of Test points and adjustments are shown here and in Section V, ADJUSTMENTS.



1. REMOVAL PROCEDURE:

a. Remove RF Plug-in from mainframe.

b. Remove retainer ring holding DS1 in mounting clip and slide over leads.

c. Remove DS1 from backside of front panel while pushing on DS1 at front side of front panel.

NOTE

To facilitate removal, pull on the leads of DS1 with a pair of needlenose pliers.

d. Unsolder anode and cathode leads.

2. INSTALLATION PROCEDURE:

a. Ensure that retainer ring is over leads before soldering.

b. Connect (solder) white-red wire to anode (long lead) of DS1, and white-red-orange wire to cathode (short lead) of DS1.

NOTE

On some Light-Emitting Diodes (LED) the leads are the same length and the cathode is designated by a white dot.

c. Push DS1 into mounting clip until it snaps into place.

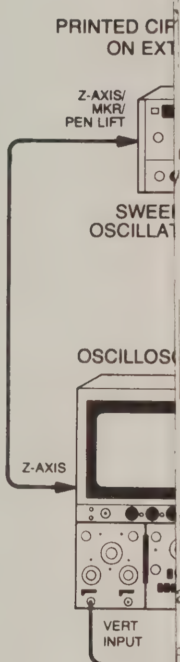
d. Install retainer ring around mounting clip.

Figure 8-2. UNLEVELED Lamp Removal and Replacement Procedure

Table 8-1. Service Sheet Cross-Reference

Service Sheet	Assembly Numbers	Schematic	Component Locations
1	**A1**, A2, A3, A6, A7, A8, A10, A12A1, CR1 and Front Panel	Figure 8-10	Figure 8-9
2	A1, **A2**, A3, A4, A5, A6, A7, A12, Front and Rear Panels	Figure 8-14	Figures 8-11 and 8-13
3	A1, A2, **A3**, A4, A5, A7, A9, Front and Rear Panels	Figure 8-18	Figure 8-15 and 8-17
4	A1, A2, A3, **A4**, A5, A7, A9, and Rear Panel	Figure 8-20	Figure 8-19
5	A1, A2, A3, A4, **A5**, A6, A7, and A8	Figure 8-23	Figure 8-22
6	A1, A2, A3, A5, **A6**, A7, A8, and Rear Panel	Figure 8-26	Figure 8-25
7	**A7**, A8, and Front and Rear Panels	Figure 8-28	Figure 8-27
8	A7, **A8**, DC1 and Front Panel	Figure 8-31	Figures 8-29 and 8-30
9	A1, A2, A7, **A9**, **A10, A10A1, A11,** A12, and A12A1	Figure 8-35	Figures 8-32, 8-33, and 8-34
10	A2, A7, A10A1, **A12, A12A1**, and Rear Panel	Figure 8-37	Figure 8-36
11	A1, A7, A9, A10, and **Rear Panel**	Figure 8-40	Figures 8-38 and 8-39

86290



EQUIPMEN

* Part of A

** To moun the main

*** RF OUT

'MENT REQUIRED:

Sweep Oscillator Mainframe	HP 8620C
RF Plug-In	HP 86290B
DC Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Extender Board	HP P/N 86290-60020
Extender Cable	HP P/N 08620-60032
10-dB Attenuator*	HP 8491B, Option 010
Crystal Detector*	HP 8470B, Option 012
10:1 Divider Probe	HP 10004D

620C:

CW MARKER pointer	Center-scale
MARKERS	OFF
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1-.01
TIME-SECONDS Vernier	Fully clockwise
1k Hz SQ WV/OFF (rear panel)	OFF
DISPLAY BLANKING/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING
LINE	ON

6290B:

RF OUTPUT	ON
ALC	INT
POWER LEVEL	Maximum Specified Leveled Power
SLOPE-OFF	OFF
FM-NORM-PL (rear panel)	NORM

'itions for waveforms and DC voltages on schematics are as follows:

Vaveforms taken in Band 4, FULL SWEEP, SWEEP TIME 10 ms.

)C Voltages are measured in CW mode, Band 4, CW MARKER pointer set to center of band 'Measure +5.000 Vdc at 8620C A2TP5).

'es noted within circuits are ±10% tolerance.

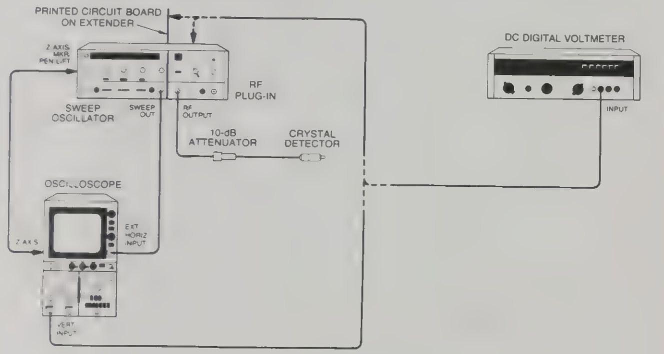
)UTPUT termination.

Figure 8-4. Schematic Diagram Notes (3 of 3)

SCHEMATIC DIAGRAM NOTES

86290B:

RF OUTPUT	ON
ALC	INT
POWER LEVEL	Maximum Leveled Power
SLOPE-OFF	OFF
FM-NORM-PL (rear panel)	NORM (Normal)



Test Setup for Waveforms and DC Voltages Shown on Schematics

EQUIPMENT REQUIRED

Sweep Oscillator Mainframe	HP 8620C
RF Plug-in	HP 86290B
DC Digital Voltmeter (DVM)	HP 3460B
Oscilloscope	HP 182C/1801A/1820C
Extender Board*	HP 86290-60020
Extender Cable**	HP 08620-60032
10-dB Attenuator***	HP 8491B, Option 010
Crystal Detector***	HP 8470B, Option 012
10:1 Divider Probe	HP 10004A

* Part of Accessories Supplied (Figure 1-1).

** To mount the A1, A2, or A3 boards on the extender board, the RF Plug-in must be removed from the mainframe and connected to the extender cable. (See Figure 1-3 and Paragraph 2-20.)

*** RF OUTPUT termination.

Figure 8-3. General Information on Schematic Diagrams

SCHEMATIC DIAGRAM NOTES

For symbols not shown, refer to USA Standard Y32.2 – 1967 "Graphic Symbols for Electrical and Electronic Diagrams."

Logic Symbols used conform to MIL-STD-806B (Military Standard 806B) "Graphic Symbols for Logic Diagrams."

Resistance is in ohms, capacitance is in picofarads, and inductance is in microhenries unless otherwise noted.

Thermistor

* Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

Screwdriver adjustment — Panel control

Encloses front panel designations

Encloses rear panel designation

Circuit assembly borderline

Other assembly borderline

Heavy line with arrows indicates path and direction of main signal.

Heavy dashed line with arrows indicates path and direction of main feedback.

CW — Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Numbers in stars on circuit assemblies show locations of test points.

Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower strip; e.g., 947 denotes white base, yellow wide stripe, violet narrow stripe.

Light-emitting diode.

Voltage regulator (breakdown diode).

Denotes Field Effect transistor (FET) with N-type base.

Figure 8-4. Schematic Diagram Notes (1 of 3)

SCHEMATIC DIAGRAM NOTES

Denotes FET with P-type base.

Feed-through capacitor (shunt capacitor, commonly used for bypassing high frequency currents to chassis).

Low Current Ground.

High Current Ground.

Frequency Reference Ground.

Operational Amplifier (integrated circuit).

Relays shown are in de-energized position.

SCHEMATIC DIAGRAM NOTES VOLTAGES AND WAVEFORMS

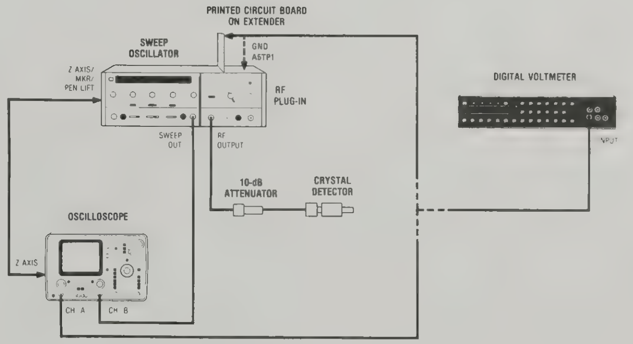


Figure 8-4. Schematic Diagram Notes (2 of 3)

EQUIPMENT REQUIRED

Sweep Oscillator Mainframe	HP 8620C
RF Plug-In	HP 86290B
DC Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Extender Board	HP P/N 86290-60020
Extender Cable	HP P/N 08620-60032
10-dB Attenuator*	HP 8491B, Option 010
Crystal Detector*	HP 8470B, Option 012
10:1 Divider Probe	HP 10004D

8620C:

CW MARKER pointer	Center-scale
MARKERS	OFF
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	1-.01
TIME-SECONDS Vernier	Fully clockwise
1k Hz SQ WV/OFF (rear panel)	OFF
DISPLAY BLANKING/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING
LINE	ON

86290B:

RF OUTPUT	ON
ALC	INT
POWER LEVEL	Maximum Specified Leveled Power
SLOPE-OFF	OFF
FM-NORM-PL (rear panel)	NORM

Conditions for waveforms and DC voltages on schematics are as follows:

a. Waveforms taken in Band 4, FULL SWEEP, SWEEP TIME 10 ms

b. DC Voltages are measured in CW mode, Band 4, CW MARKER pointer set to center of band (Measure +5.000 Vdc at 8620C A2TP5)

Voltages noted within circuits are ±10% tolerance

* RF OUTPUT termination.

Figure 8-4. Schematic Diagram Notes (3 of 3)

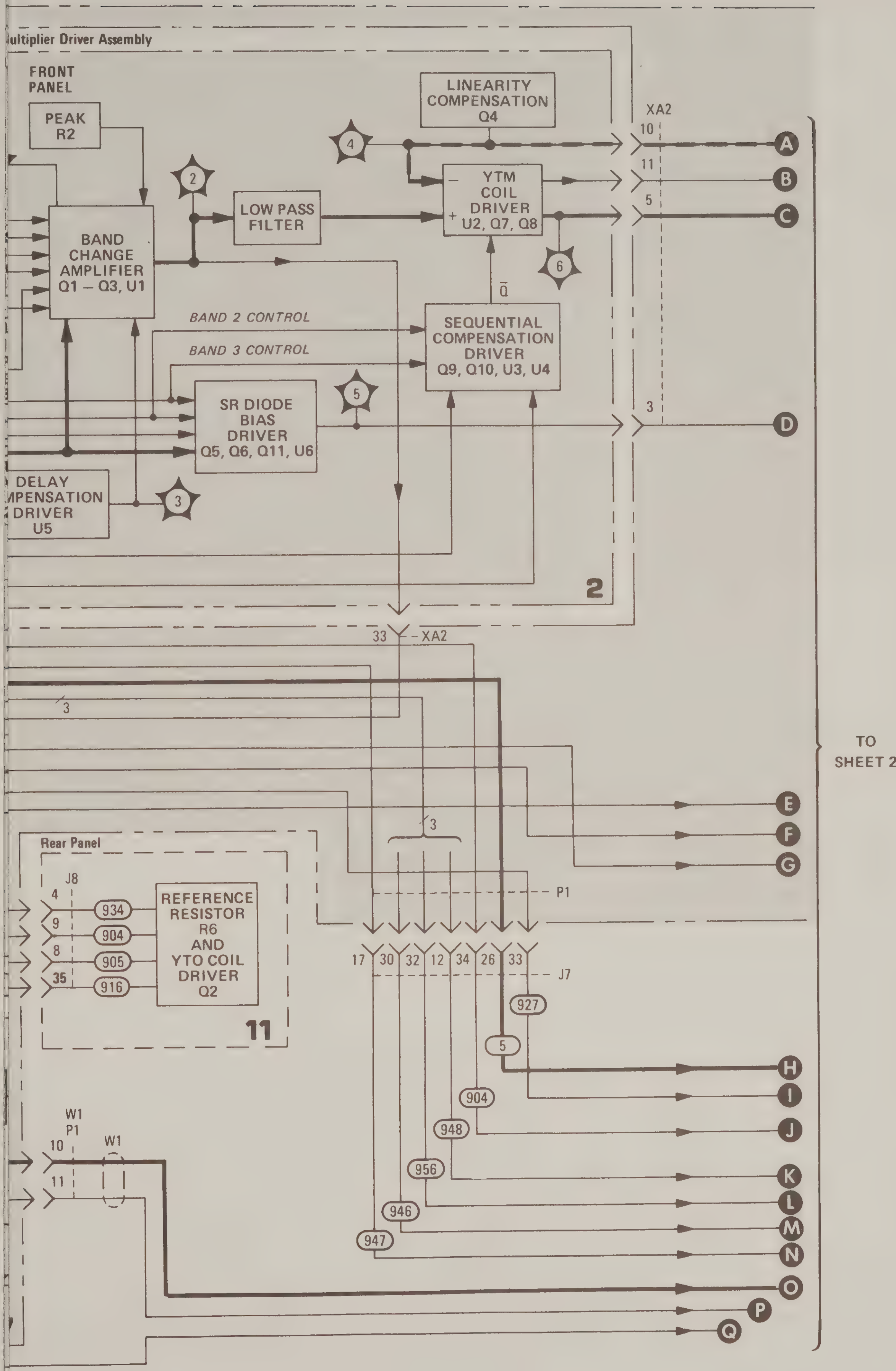


Figure 8-5. Troubleshooting Block Diagram (1 of 2)

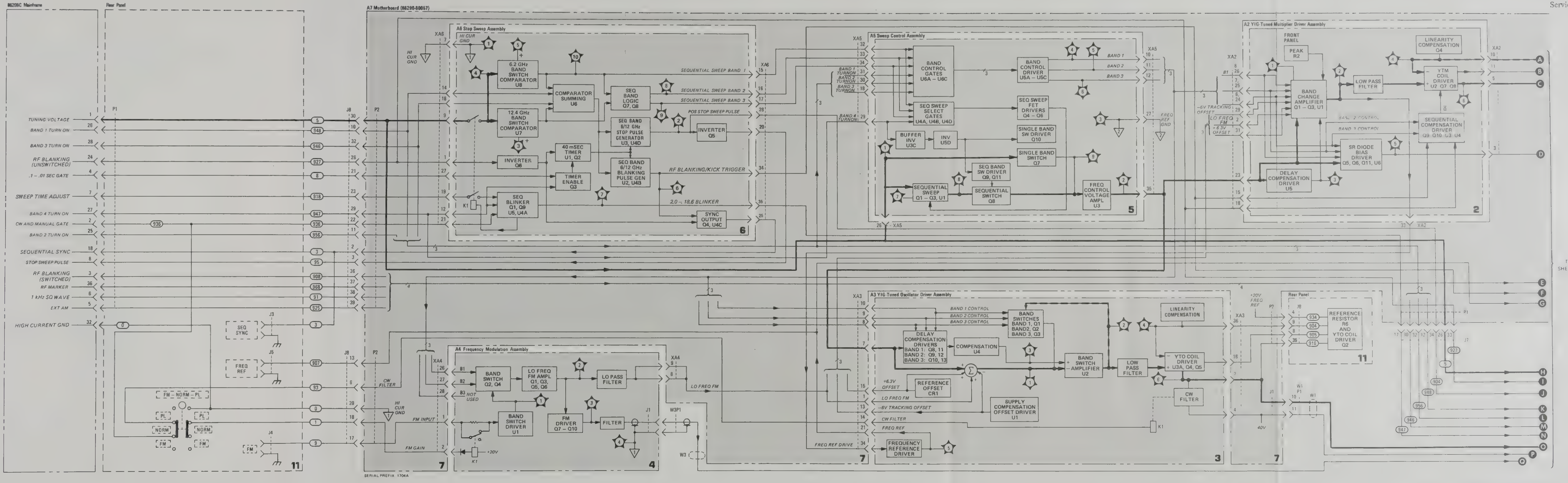


Figure 8-5. Troubleshooting Block Diagram (1 of 2)

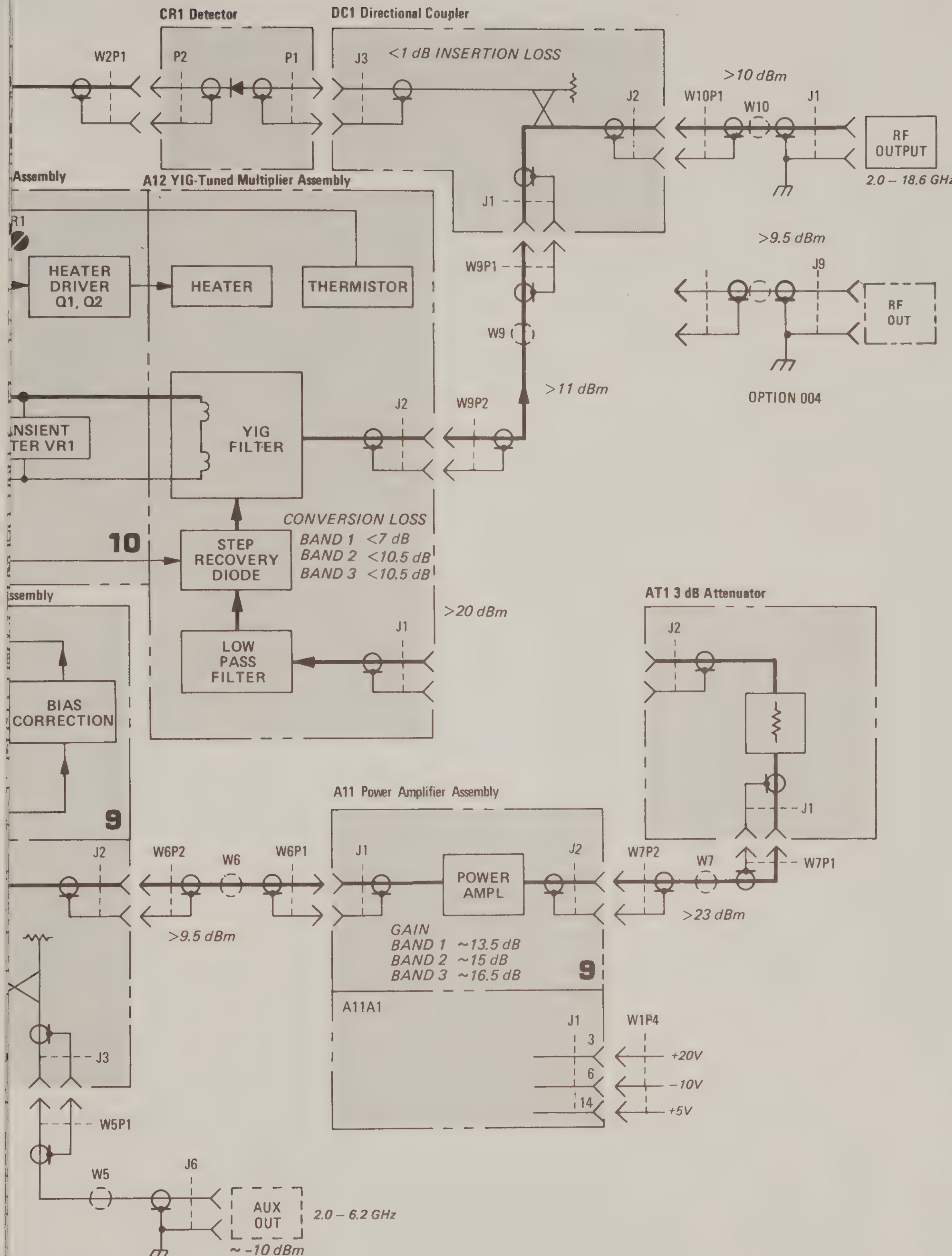


Figure 8-6. Troubleshooting Block Diagram (2 of 2)

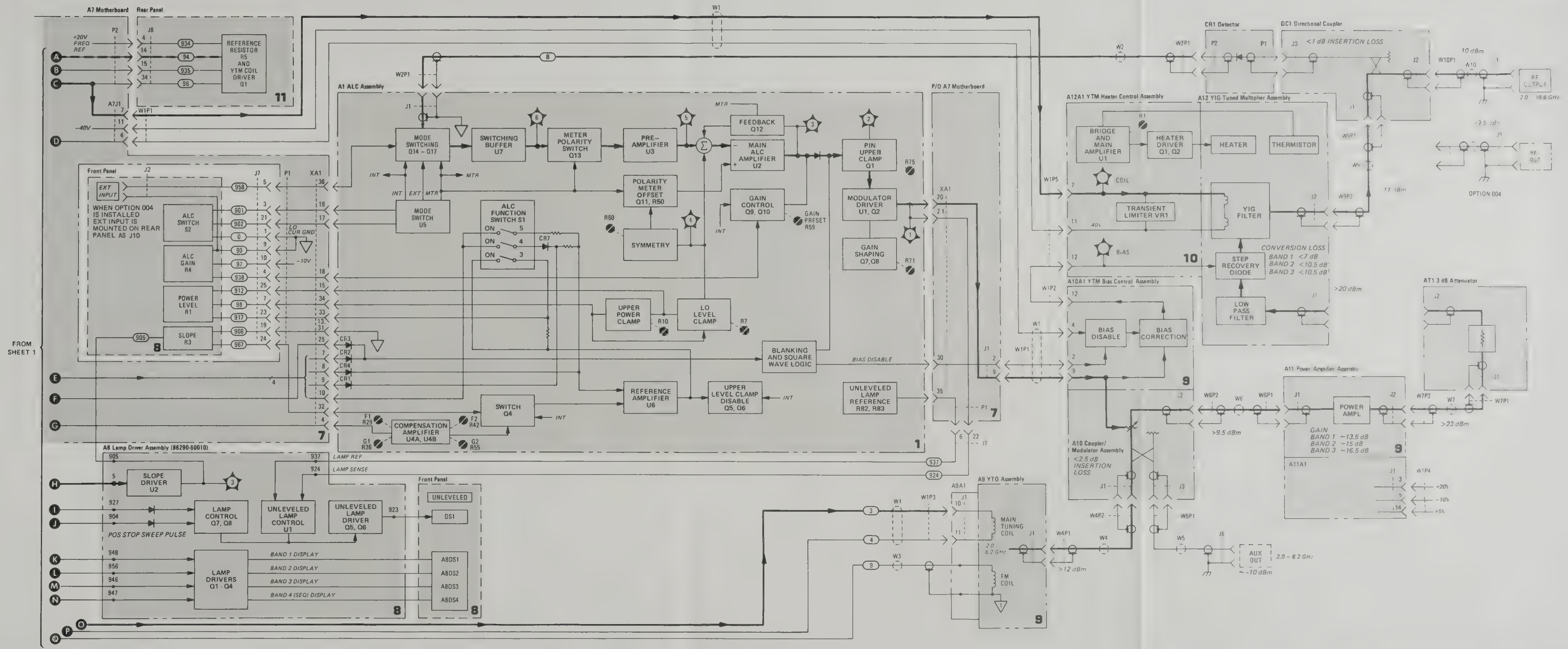


Figure 8-6. Troubleshooting Block Diagram (2 of 2)

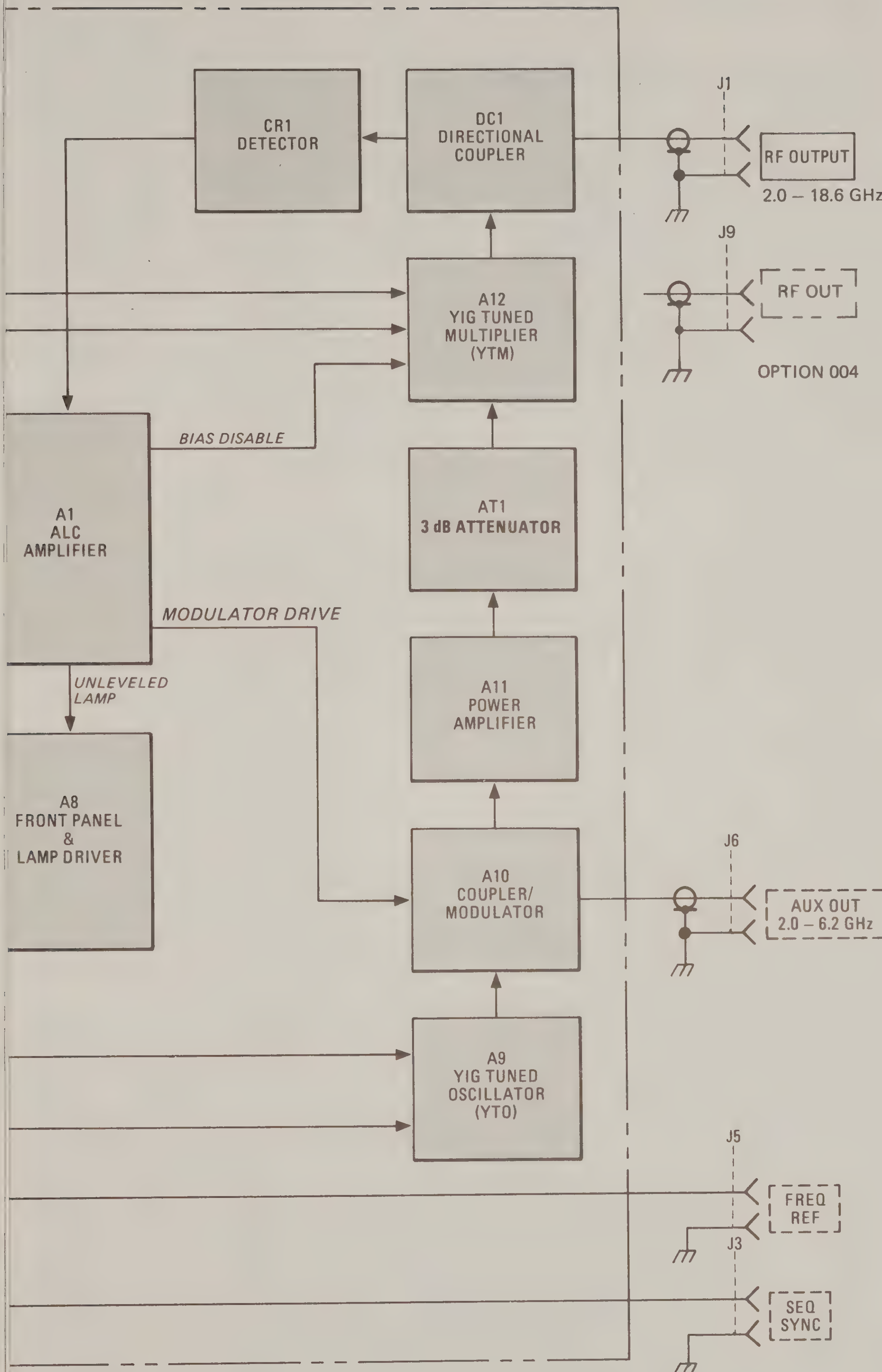


Figure 8-7. Functional Block Diagram

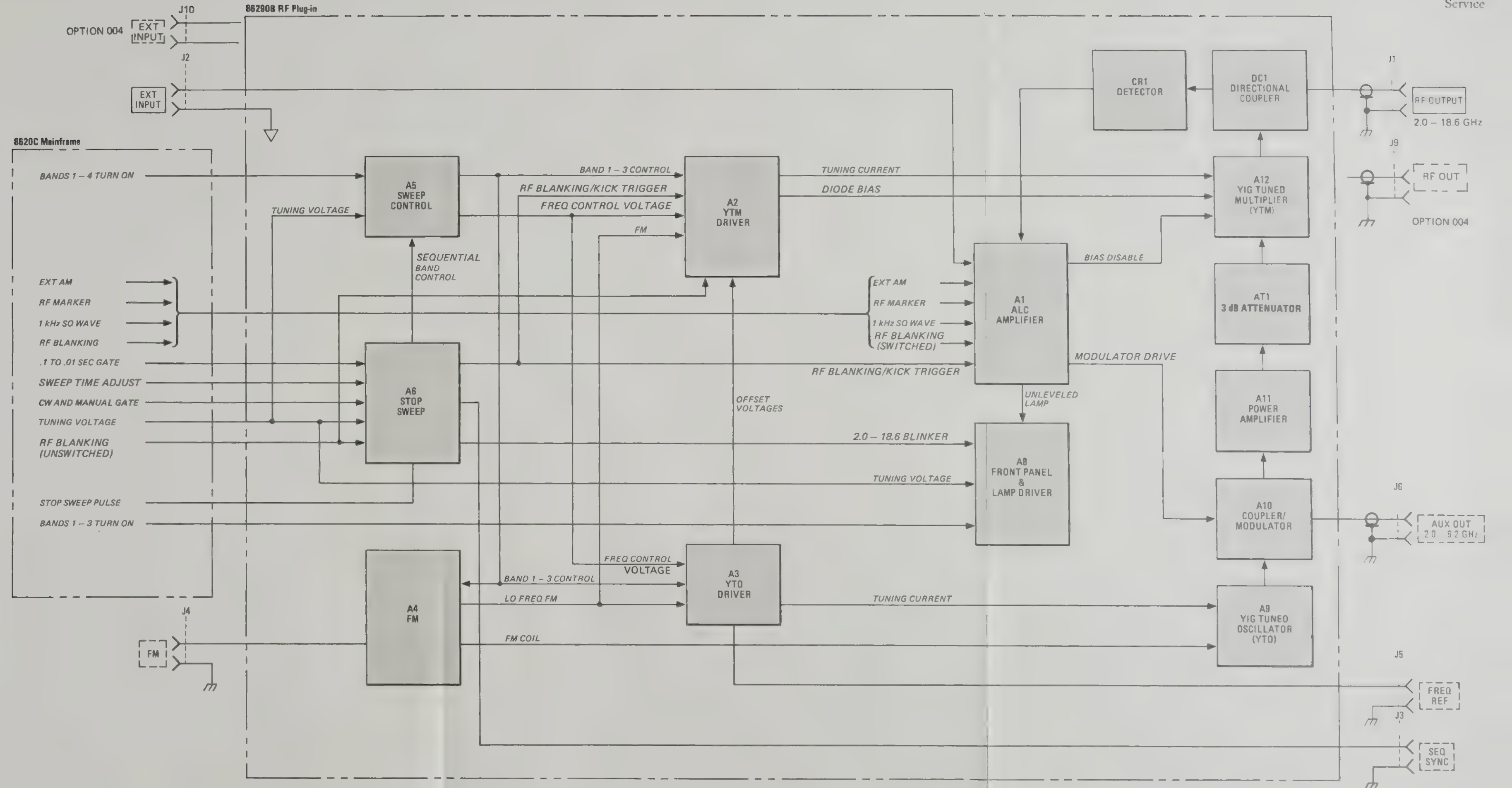


Figure 8-7. Functional Block Diagram

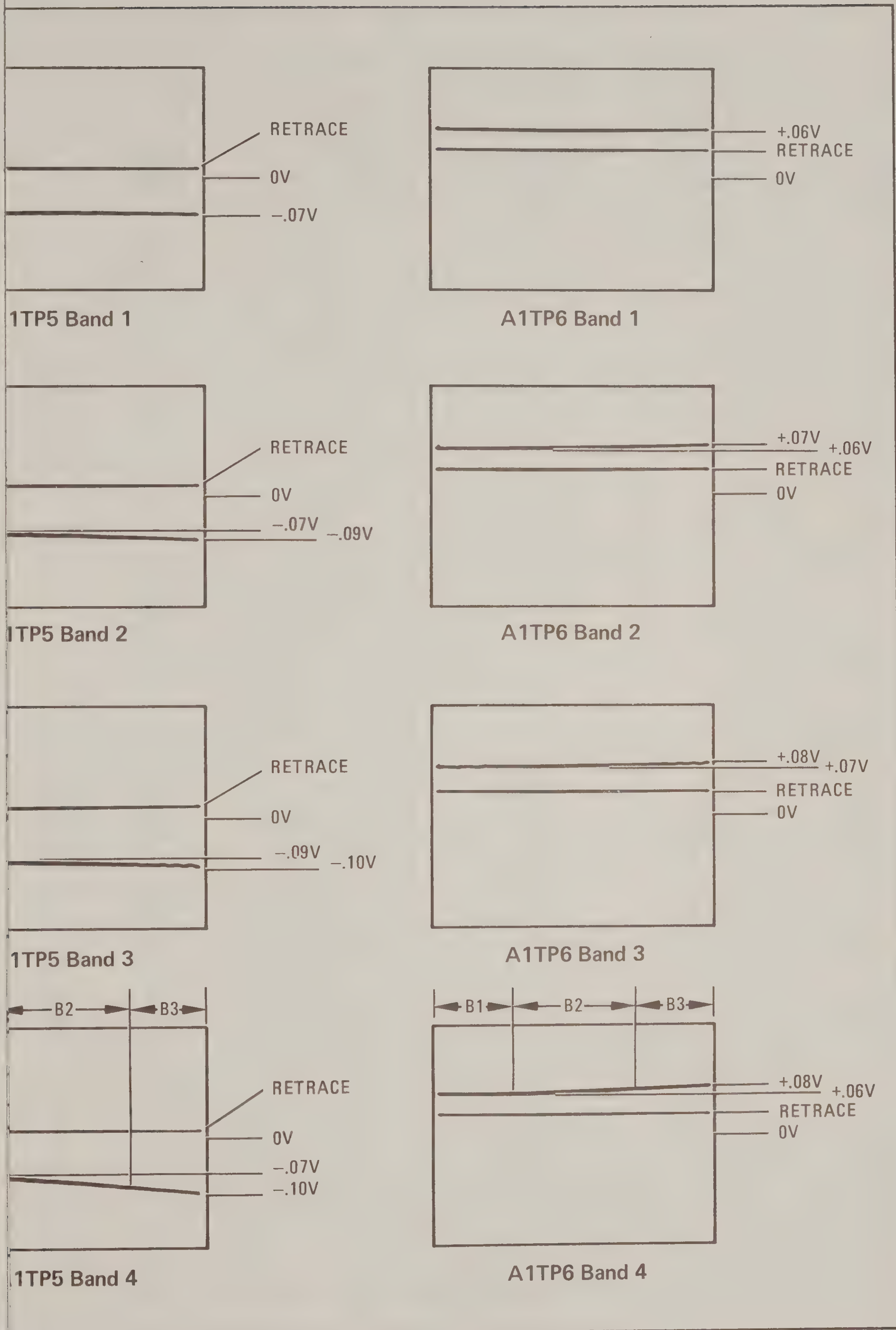


Figure 8-8. A1 ALC Assembly, Waveforms (3 of 3)

SERVICE SHEET 1

A1 ALC ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A1 ALC Assembly contains circuitry to produce compensated, automatic leveling control of the RF SIGNAL OUTPUT. In the INTernal mode of operation, a portion of the output signal is coupled from the Directional Coupler DC1 to the Detector CR1. The detector supplies a voltage to the ALC assembly: this voltage is proportional to the output signal and is amplified and compared with a reference signal. The difference between these two signals is amplified and applied to the modulator as a control voltage. Compensation is added to the reference signal to correct for coupler/detector frequency-dependent variations. In the ALC assembly, a reference amplifier supplies a dc reference voltage across the POWER LEVEL control R1. Modulation signals are also applied to the reference amplifier for modulating the RF Output. EXT AM square-wave or sine-wave modulation signals are available from the mainframe together with the 1k Hz square wave and RF markers.

In ALC EXTernal leveling mode of operation, the power-related voltage, from an external detector, is connected to the front panel EXT INPUT connector. The signal is amplified through the ALC loop and routed to the Coupler/Modulator as in the INTernal mode. In MTR leveling mode, this voltage is provided by a power meter. The power meter recorder output is connected to the front-panel EXT INPUT connector. The operating characteristics of the main ALC Amplifier U2 are modified to compensate for the slower response of the power meter.

Compensation Amplifier

General. In the INTernal mode only, a correction is added to the ALC loop to compensate for the Coupler/Detector errors. The compensation amplifier consists of an inverting operational amplifier U4A, a noninverting amplifier U4B, clamping diodes, slope and gain controls, and associated circuitry. The 1 V/GHz FREQuency REFerence ramp voltage is applied to the inputs of a dual operational amplifier U4. The ramp is sweeping between 2 and 18.6 GHz and, depending upon the value of the ramp voltage at a given frequency, an offset voltage is produced by both amplifiers. The outputs are routed through FET Q4 to the reference amplifier U6 pin 3. Q4 is conducting in INT mode with a ground applied to its gate from U5 pin 15.

Amplifiers U4A and U4B. The 1 V/GHz ramp voltage is applied to the inverting input of U4A. At the output, a zero-crossing clamper CR12 passes only that portion of the waveform that is below ground. Depending upon the setting of the offset potentiometer R42, the ramp sweeps from zero in a negative direction and emerges from zero at whatever frequency is set by the offset adjust R42. The 1 V/GHz ramp is also applied to the noninverting input of U4B. At the output, zero-crossing clamper CR8 passes only that portion of the waveform that is above ground. The point at which this positive-going ramp emerges from zero and begins to go positive is adjusted by offset R29. The resulting compensation applied to U6 is a negative-going ramp that starts anywhere between 2 and 18.6 GHz and also a positive-going ramp that starts anywhere between 2 and 18.6 GHz. The combination of these two ramps provides the shapes necessary to compensate for the detector and coupler.

The slope of the ramp is controlled by gain adjustments R36 and R55. These two adjustments, together with R27, form a voltage divider that determines what percent of the negative and positive ramps will be applied to the input of U6. If R36 is adjusted towards ground (R36 shorted), the maximum percentage of the slope is applied to U6 and hence the largest slope. When R36 is adjusted to 200K ohms, there is a minimum percentage of the ramp and hence the smallest slope. The same operation, but with different polarity, applies to voltage-divider R55/R28. Diodes CR9 and CR13 are temperature-compensating diodes.

The front-panel SLOPE control R3 provides additional compensation for high-frequency power losses in external RF cables. The Tuning Voltage is used as a frequency-reference voltage at one end of R3. At lower frequencies, the power is attenuated to provide a leveled RF output signal. In the OFF position, the wiper of R3 is grounded removing the attenuation. The resistor R12 isolates the source of Q4 and allows continued compensation from amplifier U4.

Reference Amplifier

General. The reference amplifier U6 provides a dc reference voltage at one end of the POWER LEVEL control R1. This reference voltage sets the operating point of the ALC loop. In the absence of any modulation, R28 provides a constant offset voltage of approximately +2.4 volts at the output of U6. The +2.4V corresponds to a maximum unleveled power. Any positive-going modulating signal applied to U6 pin 2 is inverted and goes negative from the +2.4V reference offset. A voltage divider, at the other end of the POWER LEVEL, sets a voltage that corresponds to 0 dBm. The input to U6 pin 3 is the output of the compensation amplifier (INT mode) and SLOPE control compensation. The modulation signals from the mainframe; EXT AM, 1 kHz SQ WAVE, and RF MARKER, are summed into the inverting input.

RF Blanking. The positive RF Blanking pulse is routed through CR2 to the YTM Bias Assembly A12A1 and through CR18 to the base of Q1 driving the PIN diodes in the modulator to maximum attenuation. Also during the positive cycle, the Step Recovery Diode (SRD) in the YTM is disabled.

Modulation Signal Inputs. The modulation inputs from the 8620C mainframe consist of the RF MARKER pulse, 1 kHz SQ WAVE, and EXT AM. Their action at the inverting input of U6 is as follows. A positive marker pulse is routed through CR4 to U6 pin 2 to amplitude modulate the RF output. The 1 kHz SQ WAVE at CR1 is applied to U6 pin 2 through R25. It is also applied directly to the ALC loop through CR16 and R67 to the base of Q1. There is a choice of two modes of operation with the EXT AM input: nonlinear and linear mode. In nonlinear mode, the ALC Function Switch A1S1-4 is UP and A1S1-5 is DOWN. Diode CR7 is in series and the EXT AM modulation is applied directly to the ALC LOOP, through CR16 and R67. Routing the signal directly into the ALC loop, in both EXT AM and 1 kHz SQ WAVE modulation, increased the ON/OFF ratio. With the ALC Function Switch A1S1-5 UP or with sine wave modulation ON the EXT AM is in linear mode; A1S1-4 is open and the EXT AM modulation is connected through R21 to the op-amp input. The combination of A1S1-4 UP and S1-5 DOWN allows a square wave to be applied directly to the modulator driver and to the reference circuit, whereas the sine wave modulation is applied only to the reference amplifier. Only one Modulation Mode should be selected at a time. With both switches UP, the modulation is undefined; this mode has no known usefulness.

Low Level Clamping. There are two levels of clamping; one is for the voltage source which sets the power reference, and the second is for the modulation signals.

The lower power level is adjusted to 0 dBm by LO LEVEL CLAMP potentiometer R7. Since more current can flow through the voltage divider R6 and R7 than is required by the op-amp U6, a voltage source is formed by R6 and R7. The voltage set by R7 and applied to the cathode of CR5 corresponds to the 0 dBm lower power level. Modulating signals with high amplitudes back-bias diode CR5 and the second level of clamping takes over. Diode CR5 also provides temperature compensation for Q3.

Transistor Q3 is an emitter follower that provides clamping for high amplitudes of modulation. The emitter is connected to a voltage source set by VR3, R61, and R62. The SYMMETRY potentiometer R60 sets the lower limit of closed-loop operation at a voltage that corresponds to about −10 dBm. Below −10 dBm, the loop opens to drive the modulator directly. If closed-loop operation is attempted below −10 dBm, the modulator saturates. The modulation coupled through the reference amplifier is clamped by Q3 at −10 dBm; however, the 1 kHz SQ WAVE and EXT AM (nonlinear mode) are applied simultaneously direct[illegible] the modulator driver for the required ON/OFF ratio.

High Level Clamping. The high level clamping sets the upper power reference and is adjusted by UPPER POWER CLAMP potentiometer R10. A voltage divider is formed by R37, R10, and the POWER LEVEL control. When the POWER LEVEL control is fully clockwise (at the upper end), the ratio of R27 and R10 determines the clamped voltage level. Adjusting R10 sets the voltage for upper power clamping and is normally set at +13 dBm. CR5 prevents nonlinear modulation from increasing the power above the high level set. Switching the ALC Function Switch S1-3 to the UP position, shorts out R37 and removes the upper power clamp. Also, in EXT and MTR modes, Q5 shorts out R37 to remove this clamping. The mode switching in INT mode turns Q6 ON, latching +10V to the gate of Q5, to hold Q5 OFF.

Automatic Level Control (ALC) Loop Amplifier

Mode Switching and Switching Buffer Amplifier. The ALC loop receives error signal inputs from either an internal coupler/detector (INT mode), external detector (EXT mode), or power meter (MTR mode). Mode Selection occurs when the ALC mode switch S2 provides either LO or HI inputs to a binary-to-decimal converter U5. A ground or 0 volt ouput from U5 turns ON the N-channel FETs for the mode selected. In INT mode, FETs Q4, Q16, and Q10 turn ON; Q4 connects the compensation amplifier ouput to the reference amplifier, Q16, switches the signal from Detector CR1 to the inverting input of U7 (U7 gain is set by R8 and R23), and Q10 ensures that Q9 will be ON to bypass R65 so there is no reduction in the ALC loop gain. The FETs used by EXT and MTR mode switching are back biased in INT mode with −10V from the EXT and MTR outputs of U5.

In EXT mode, Q15 is ON and couples the signal from the front-panel EXT INPUT connector J2 to U7. The signal path and gains are the same as in INT mode. The conduction of Q9 is variable depending upon the setting of ALC GAIN control R4. When Q9 is OFF (ALC GAIN fully counterclockwise), R65 decreases the loop gain by 10 dB. As the ALC GAIN control R4 is rotated clockwise, the resistance of Q9 changes and loop gain increases. In power meter (MTR) mode, FET Q14 and Q17 are ON to connect the error signal from a power meter, through an input filter network of R16, C1, and R15 (R15 provides an impedance match for the recorder output of the 432A power meter) into U7 which has approximately unity gain at dc and increases to about twenty-six around 100 Hz. This compensates for variations in the HP 432A Power Meter.

U7 Output INT Signal Test. The mode switching does not open the input circuits to U7 but instead the FETs switch resistive dividers to the input. Therefore, with INT mode selector there is a path from the output of U7, through R20 and R14, to the EXT INPUT connector J2. The signal can be checked at J2 which is an inverted gain of the detector.

Preamplification. In INT and EXT modes, the output of U7 is amplified by preamplifier U3 and applied to a summing junction at U2 pin 2. Resistors R40 and R48 set the gain at two. In EXT and MTR modes, high voltage levels may be applied to U3. When the voltage output of U3 exceeds the −1.2V voltage drop across diodes CR10 and CR7, the gain of U3 changes to one tenth. This gain change is necessary, for example, during external leveling when using a power splitter. In this case, more detected signal is applied to the loop for a given power level. Without this gain change, the maximum reference voltage of +2.4V would correspond to a power level much less than the maximum output power of the 86290B.

In MTR mode, Q13 is ON and routes the signal to the noninverting input of the preamplifier U3. Signals are now applied to both inputs. Pin 2 has a gain of two in the negative direction and pin 3 has a gain of four in the positive direction, so the ouput of U3 is a noninverted gain of two. This maintains correct signal polarity through the ALC loop, since the polarity of the power meter is opposite to the detectors.

Main ALC Amplifier. The point that controls the ALC loop is the summing junction at the inverting input of U2. Operation is as follows. For the ALC loop to operate correctly, the voltage at U3 pin 6 must be equal in value and opposite in polarity to the Reference Voltage. When the POWER LEVEL control R1 is rotated, the reference voltage level is changed. This causes U2 to drive more or less current into the modulator until U3 pin 6 is again equal to the reference voltage. The inverting input (pin 2) of U2 will always try to be at zero. Any change at the Reference Amplifier U6, due to modulation inputs for example, will cause U2 to change its drive current into the modulator.

The diode CR4, in the feedback path of U2, clamps the output of the main ALC amplifier at −0.6V. Voltage regulator VR2 and diode CR15 clamps U2 output at about +10V to keep the op-amp from saturating. Both the positive and negative output variations from U2 are clamped and gain limited.

Compensation in INT and EXT is supplied by CR13. In MTR mode, Q12 turns ON to add C14 in parallel with C13. This changes the feedback to compensate for the low response of the power meter. Also in MTR mode, Q11 is ON and adds an additional offset voltage for correct power meter operation.

The output of U2 is routed through a gain control formed by R65, R64, Q9, and Q10. If FET Q9 is OFF, R65 and R64 make up about a 3:1 voltage divider. This gives a 10-dB reduction in loop gain. If FET Q9 is ON, so that the output of U2 bypasses R65, there is no reduction in loop gain.

Q10 is ON when INT Mode is selected and latches a ground to the gate of Q9 turning it ON. However, with EXT or MTR mode selected, Q10 is open and the loop gain is determined by the front-panel ALC loop GAIN control R4. The ALC GAIN is adjusted between ground and −10V and the voltage is applied to the voltage divider of R57 and R59. The GAIN PRESET adjust R59 sets the voltage divider so the ALC GAIN has optimum range.

Diode CR17 is protection for U2 and will open if the 1 kHz square wave or EXT AM modulation, applied directly into the ALC loop, should rise above the output potential of U2 which operates into load R65 until CR16 is ON again.

PIN UPPER CLAMP and Q1. Emitter follower Q1 provides current gain and signal clamping. If the base voltage rises above 0.6V below the emitter potential, Q1 turns OFF. The loop operating point is then determined by voltage divider R74, R75, R76, and R79. If the base drops below a diode drop of 0.6V, the ouput remains at the existing potential with a modification by the same voltage divider. Resistors R76 and R79 also provide proper signal levels to U1 pin 3.

Modulator Driver and Shaper. Modulator Driver U1 is a noninverting driver stage. Transistor Q2, in the feedback circuit, supplies additional current for driving the modulator. The voltage gain of the stage is two; determined by R84 and R80. If the output at the emitter of Q2 drops below −0.6V, CR19 turns ON. This connects R1 in parallel with R80 and the gain increases to six. The loop is allowed to go to −4V to remove any residual insertion loss from the modulator. The negative polarity is essential to stop the self-rectification in the PIN diodes.

As the output becomes positive, the loop gain also increases when Q7 turns ON. Emitter follower Q8 is a voltage source for Q7. The GAIN SHAPING Potentiometer R71 at the base of Q8 sets the turn-on voltage of Q7. When the emitter of Q7 rises +0.6 volts above its base voltage, Q7 turns ON connecting R78 to ground. This increases the gain of the modulator driver to twelve. The gain of U1/Q2 varies between two and twelve determined by R70 and the setting of GAIN SHAPING adjust R71. This gain control compensates for gain reduction in the modulator at high drive levels. A 196-ohm resistor A10A1R1 on the YTM Bias Control Assembly provides the driving impedance for the modulator and protection in case of a Q2 collector-emitter short circuit.

Supply Votages. The +5 volt supply is derived from the +20V supply by the voltage drop across VR1 and resistor R9. VR1 is a 5.11V zener diode with zero temperature drift. The voltage is produced here to obtain a more noise-free +5 volt supply. The +20V and −10V are isolated by 31.6 ohm resistors. The voltages are bypassed at several places with 1.0 mF capacitors for noise filtering.

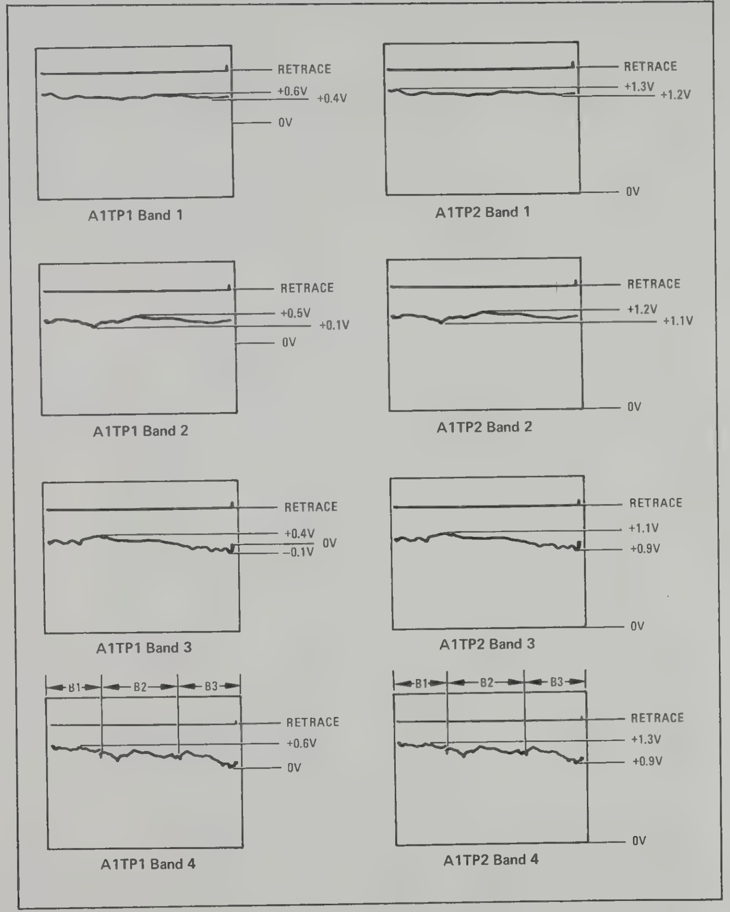


Figure 8-8. A1 ALC Assembly, Waveforms (1 of 3)

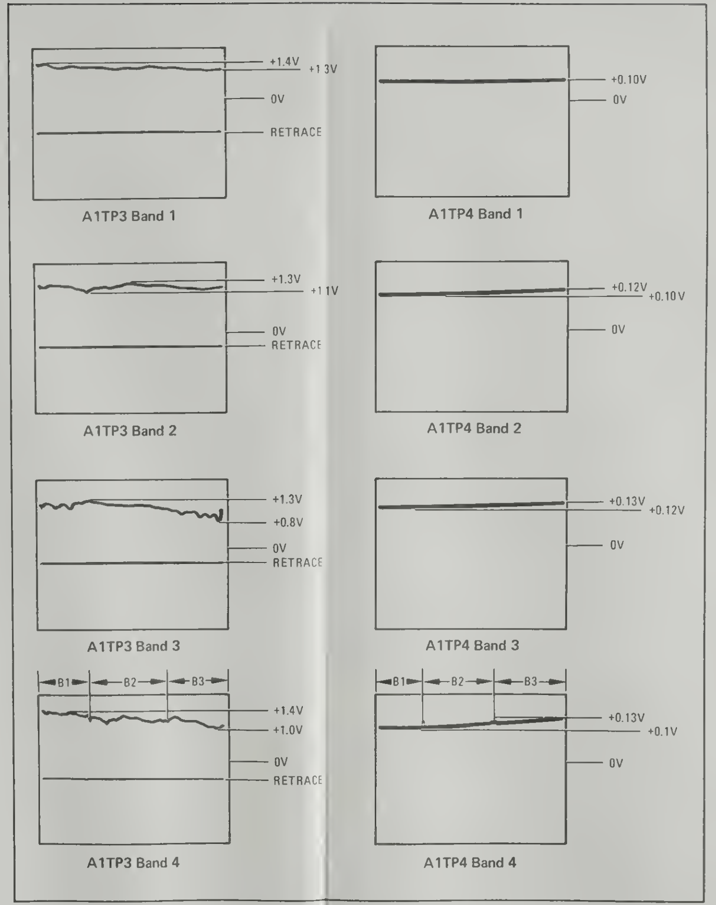


Figure 8-8. A1 ALC Assembly, Waveforms (2 of 3)

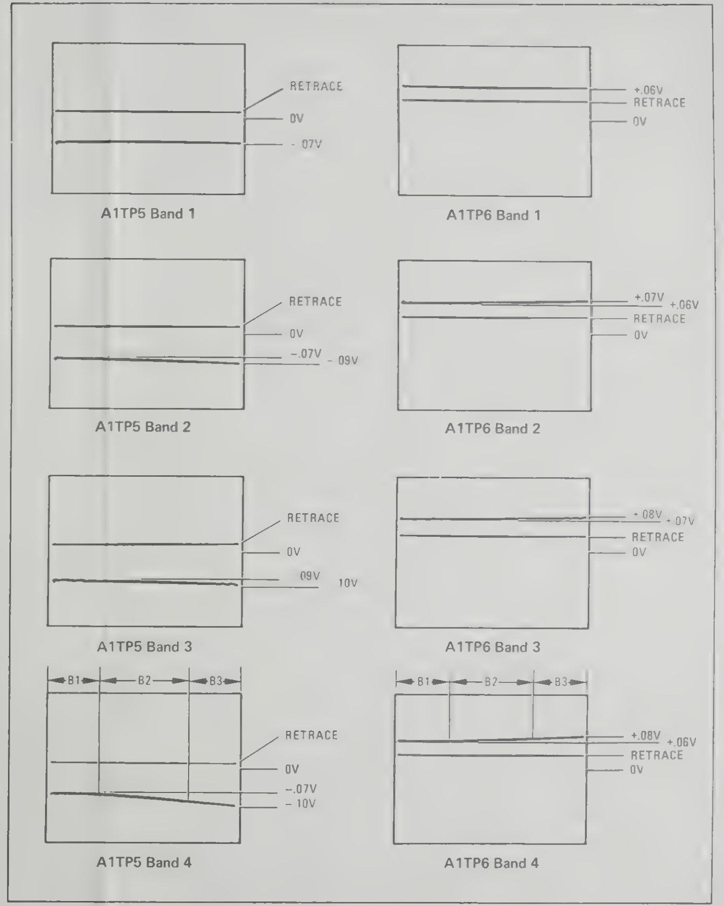
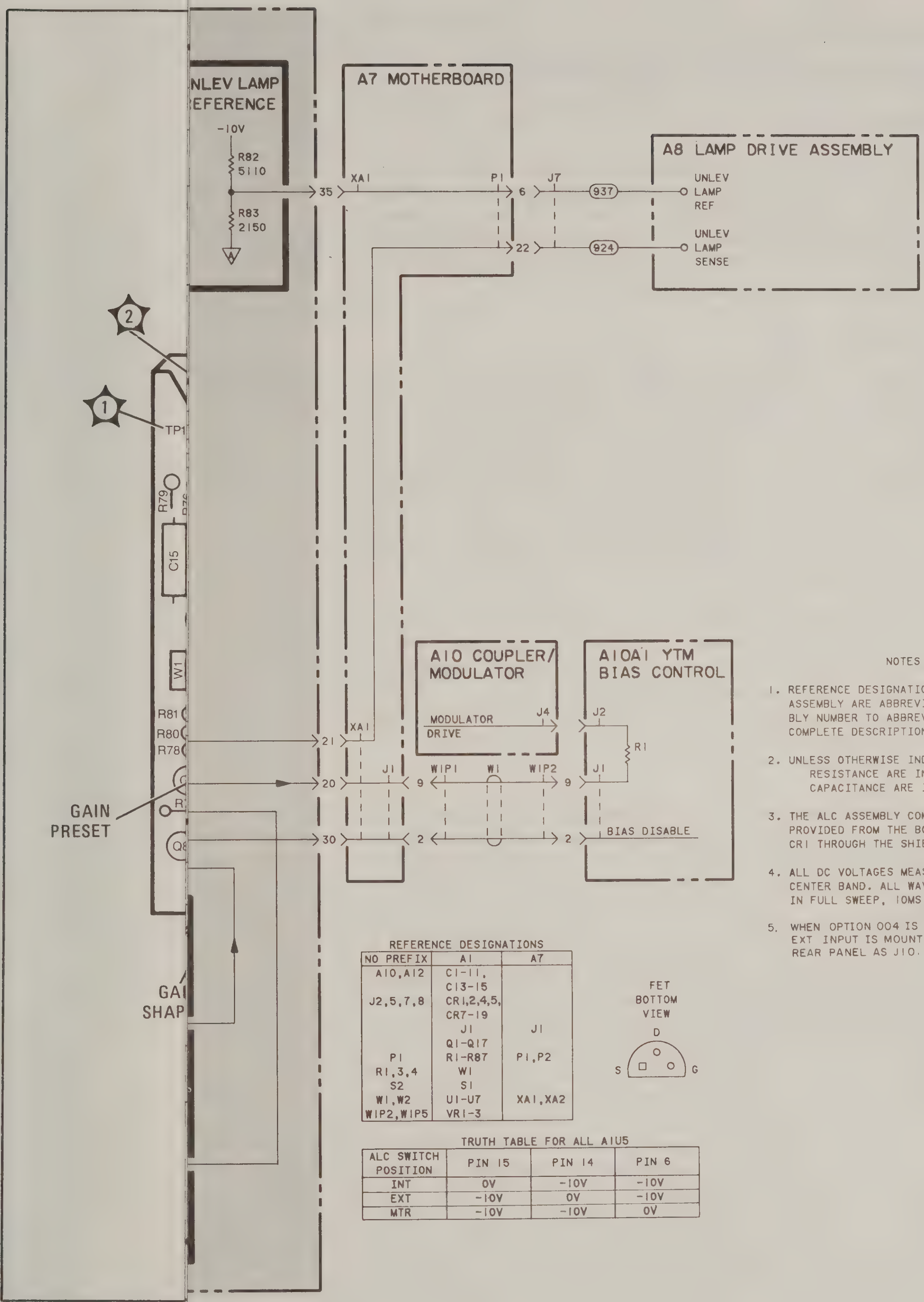


Figure 8-8. A1 ALC Assembly, Waveforms (3 of 3)



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE ARE IN OHMS; CAPACITANCE ARE IN PICOFARADS;
3. THE ALC ASSEMBLY COMMON GROUND IS PROVIDED FROM THE BODY OF DETECTOR CR1 THROUGH THE SHIELDING OF CABLE W2.
4. ALL DC VOLTAGES MEASURED IN CW, CENTER BAND. ALL WAVEFORMS MEASURED IN FULL SWEEP, 10MS.
5. WHEN OPTION 004 IS INSTALLED, EXT INPUT IS MOUNTED ON REAR PANEL AS J10.

REFERENCE DESIGNATIONS

NO PREFIX	A1	A7
A10,A12	C1-11,	
	C13-15	
J2,5,7,8	CR1,2,4,5,	
	CR7-19	
	J1	J1
	Q1-Q17	
P1	R1-R87	P1,P2
R1,3,4	W1	
S2	S1	
W1,W2	U1-U7	XA1,XA2
W1P2,W1P5	VR1-3	

TRUTH TABLE FOR ALL A1U5

ALC SWITCH POSITION	PIN 15	PIN 14	PIN 6
INT	0V	-10V	-10V
EXT	-10V	0V	-10V
MTR	-10V	-10V	0V

Figure 8-10. A1 ALC Assembly, Schematic

Table 8-2. Voltages for A1 ALC Assembly (1 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	+ 0.6	+ 0.6	+ 0.2
TP2	+ 1.4	+ 1.4	+ 1.1
TP3	+ 1.3	+ 1.2	+ 1.0
TP4	+ 0.3	+ 0.3	+ 0.4
TP5	− 0.2	− 0.2	− 0.3
TP6	+ 0.2	+ 0.2	+ 0.2
Q1-E	+ 1.4	+ 1.4	+ 1.1
Q1-B	+ 0.8	+ 0.8	+ 0.5
Q1-C	0	0	0
Q2-E	+ 0.6	+ 0.6	+ 0.3
Q2-B	+ 1.2	+ 1.3	+ 0.9
Q2-C	+ 17.9	+ 17.9	+ 17.9
Q3-E	+ 0.3	+ 0.3	+ 0.3
Q3-B	+ 17.9	+ 17.9	+ 17.8
Q3-C	+ 17.9	+ 17.9	+ 17.8
Q4-S	0	0	0
Q4-G	0	0	0
Q4-D	0	0	0
Q5-S	+ 2.5	+ 2.6	+ 2.8
Q5-G	8.5	− 8.5	− 8.5
Q5-D	+ 2.5	+ 2.6	+ 2.8
Q6-E	− 8.5	− 8.5	− 8.5
Q6-B	− 7.8	− 7.8	− 7.8
Q6-C	8.5	− 8.5	− 8.5
Q7-E	+ 0.3	+ 0.3	+ 0.2
Q7-B	− 0.1	− 0.1	− 0.1
Q7-C	0	0	0
Q8-E	− 0.1	− 0.1	− 0.1
Q8-B	+ 0.5	+ 0.5	+ 0.5
Q8-C	+ 17.9	+ 17.9	+ 17.9
Q9-S	+ 1.1	+ 1.1	+ 0.9
Q9-G	0	0	0
Q9-D	+ 1.0	+ 1.0	+ 0.8
Q10-S	0	0	0
Q10-G	0	0	0
Q10-D	0	0	0

Table 8-2. Voltages for A1 ALC Assembly (2 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
Q11-S	+ 0.5	+ 0.5	+ 0.5
Q11-G	− 8.5	− 8.5	− 8.5
Q11-D	0	0	0
Q12-S	0	0	0
Q12-G	− 8.5	− 8.5	− 8.5
Q12-D	0	0	0
Q13-S	0	0	0
Q13-G	− 8.5	− 8.5	− 8.5
Q13-D	+ 0.2	+ 0.2	+ 0.2
Q14-S	0	0	0
Q14-G	− 8.5	− 8.5	− 8.5
Q14-D	+ 0.2	+ 0.2	+ 0.2
Q15-S	0	0	0
Q15-G	− 8.5	− 8.5	− 8.5
Q15-D	+ 0.2	+ 0.2	+ 0.2
Q16-S	0	0	0
Q16-G	0	0	0
Q16-D	0	0	0
Q17-S	0	0	0
Q17-G	− 8.5	− 8.5	− 8.5
Q17-D	+ 0.1	+ 0.1	+ 0.1
U1-2	+ 0.4	+ 0.2	+ 0.2
U1-3	+ 0.3	+ 0.3	+ 0.2
U1-6	+ 1.2	+ 1.2	+ 0.9
U2-2	0	0	0
U2-3	0	0	0
U2-6	+ 1.3	+ 1.2	+ 1.0
U3-2	0	0	0
U3-3	0	0	0
U3-6	− 0.2	− 0.2	− 0.3
U4A-1	+ 0.8	+ 0.6	+ 0.3
U4A-2	− 0.4	− 0.4	− 0.4
U4A-3	− 0.4	− 0.4	− 0.4

Table 8-2. Voltages for A1 ALC Assembly (3 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U4B-5	− 0.3	0	+ 0.4
U4B-6	− 0.3	0	+ 0.4
U4B-7	− 0.3	0	+ 0.4
U5-6	− 8.5	− 8.5	− 8.5
U5-11	− 8.5	− 8.5	− 8.5
U5-12	− 8.5	− 8.5	− 8.5
U5-13	0	0	0
U5-14	− 8.5	− 8.5	− 8.5
U5-15	− 0.1	− 0.1	− 0.1
U6-2	0	0	+ 0.1
U6-3	0	0	+ 0.1
U6-6	+ 4.1	+ 4.2	+ 4.5
U7-2	0	0	0
U7-3	0	0	0
U7-6	+ 0.2	+ 0.2	+ 0.2

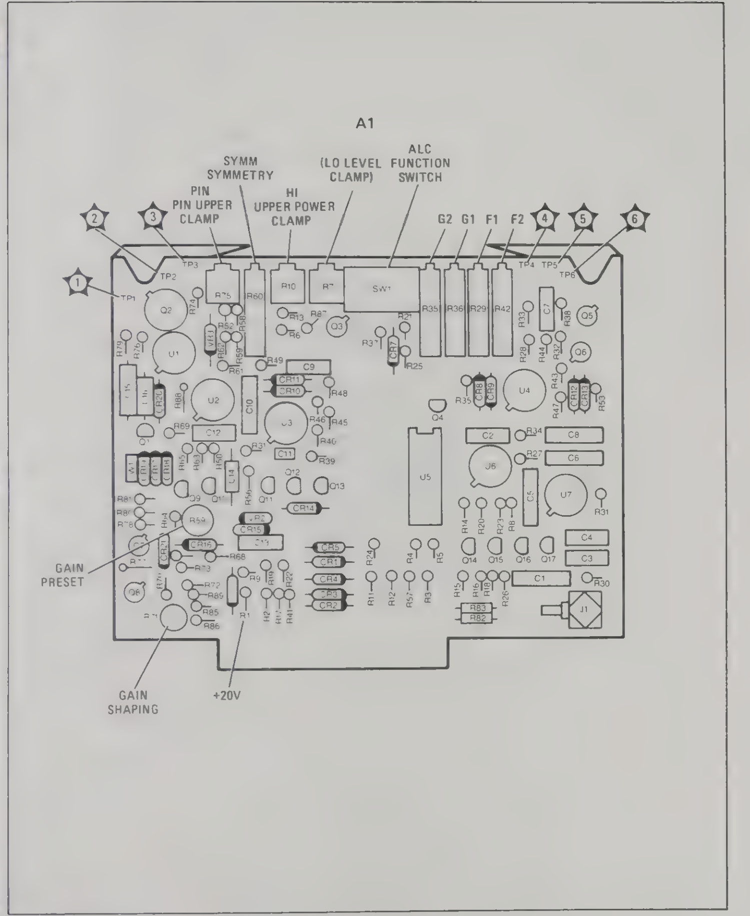


Figure 8-9. A1 ALC Assembly, Component Locations

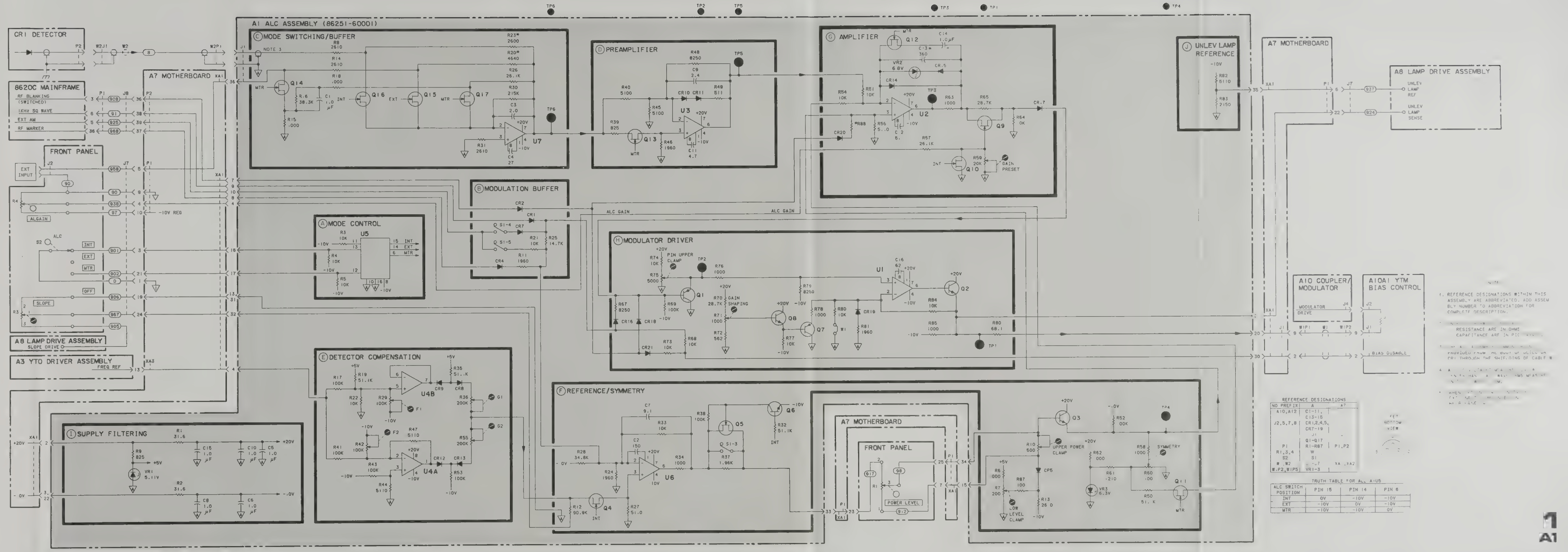


Figure 8-10. A1 ALC Assembly, Schematic

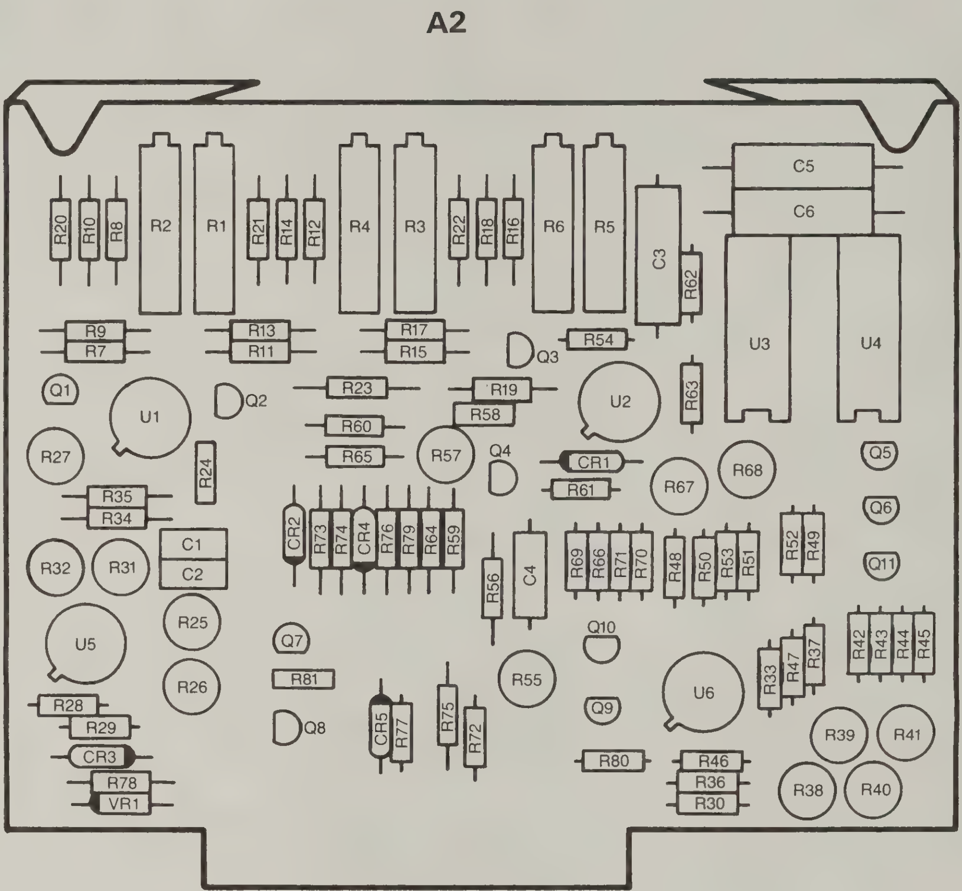
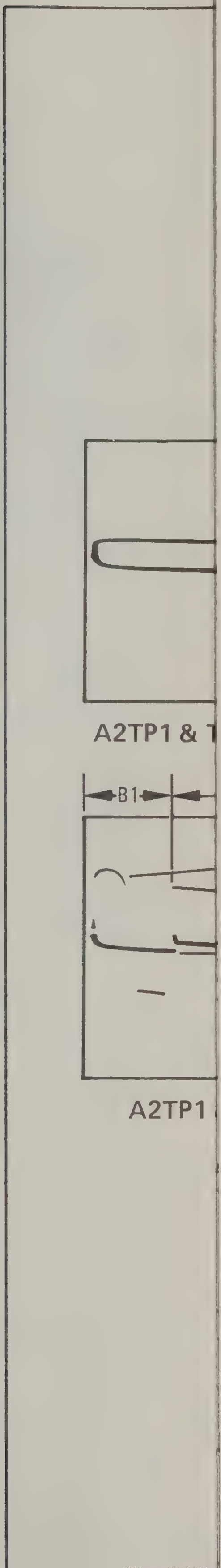


Figure 8-11. A2 YTM Driver Assembly, Component Locations


A2TP1 &
B1
A2TP1

SERVICE SHEET 2

A2 YTM DRIVER ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A2 YTM Driver Assembly provides the current to drive the YIG-Tuned Multiplier (YTM) tuning coil. Three circuits for each of the three bands provide compensation because of the inherent delays in the tuning coil. Other circuits compensate for transients developed at band-switch-points during the sequential sweep. The step recovery diode (SRD) bias driver circuit is contained on the YTM driver assembly.

Band Change Amplifier

The Band Change Amplifier U1 can operate in three different bands. The bands are selected by turning ON one of three transistors: Q1, Q2, or Q3. With Band 1 selected, the band control gates and driver on the 86290B A5 assembly provide 0V to turn ON Q1. Connected through Q1 to the inverting input of U1 is a resistor network containing five resistance paths: four are inputs and one is a feedback resistor. The feedback resistor R20 is in parallel with R23 which is always in the circuit. The ZERO adjust R27 reduces the effect of temperature drifts in the operational amplifier U1.

Frequency Control Voltage. The first of the four inputs is the frequency control voltage from the A5 Sweep Control Assembly. This 0 to 10 volt ramp provides tuning across the entire band. The adjustment R1 peaks the power at the high frequency end of the band when the frequency control voltage is at 10 volts. In Band 1, R1 adjusts the power at 6.2 GHz; in Band 2, R3 adjusts the power at 12.4 GHz, and in Band 3, R5 adjusts the power at 18.6 GHz.

+6.3V Offset Voltage. The +6.3V Offset input allows control of the power when the frequency control voltage is zero. The power at the low end or at 2.0 GHz is adjusted with R2 in Band 1; in Band 2, the power at 6.2 GHz is adjusted with R4; and in Band 3, R6 adjusts at 12.4 GHz.

LO Frequency FM. The LO Frequency FM input allows low frequency FM up to 500 Hz. With this input, the sweeper is capable of a wider frequency deviation than would be possible with only a signal applied to the FM coil of the oscillator. This same LO Frequency FM is applied to the YIG-Tuned Oscillator (YTO) so the YTO and YTM track over a wide range in FM operation.

−6V Tracking Offset Voltage. The −6V Tracking Offset input from the A3 YTO Driver Assembly is derived from the +20V Freq Ref. If the +20 Frequency-reference voltage should change value, the tracking offset provides an equal and opposite voltage change. The net result would be no noticeable voltage change across the reference resistor R5 on the rear panel.

PEAK Tracking Adjust

The front-panel PEAK control R2 provides a + or − offset to optimize the pass band of the YTM for maximum power.

Delay Compensation Driver

The Delay Compensation Driver U5A and U5B is a pair of ac coupled amplifiers whose input is the frequency control voltage. Their function is to produce an exponential waveform. For each sweep cycle of the frequency control voltage, the delay compensation amplifiers produce repetitive exponential waveforms. The waveforms are adjustable. The t adjustments, ts R25 and to R26, control the time constants and the M adjustments, Ms R31 and Mo R32, adjust the magnitude (amplitude) of the exponential waveforms. The waveforms are coupled to the noninverting input of U1. The junction of U1 pin 3 and R24 produces a pseudosumming node. A voltage divider, made up of R24 and either R34 or R35, divides the voltage so only a very small signal is at U1 pin 3. This causes pin 2 to follow the exponential waveform exactly since all inputs are fixed to a given voltage at any one time. Since pin 2 follows pin 3, a small exponential waveform is superimposed on the sweep output at U1 pin 6. This compensation offsets the inherent delays existing in the magnet of the YIG-Tuned Multiplier A12.

YTM Driver

The YTM Driver circuit consists of an operational amplifier U2 followed by three transistors: Q7, Q8, and rear-panel mounted Q1. These three transistors are connected in a quasi-darlington configuration and together form an emitter follower. The base of this emitter follower is the base of Q8 and the collector is the collector of Q1. This circuit provides the current to drive the YTM tuning coil.

For a given voltage at the band change amplifier output, TP2, the collector of Q1, TP4, follows that voltage. Therefore, for a specific voltage at TP2 there will be a specific tuning-coil current. The purpose for using the triple-of-transistors is to provide very low leakage currents. All drive current for the tuning-coil current must flow through Q1 and the rear-panel mounted frequency-reference resistor R5. The only sources of leakage current from R5 are from the bias voltages for U2 pin 2 and the base of Q8. However, these two current drains are negligible when compared to the 0.25A peak current through the tuning coil. Since these leakage currents are low, a good relationship is obtained between voltage at TP4 and the current through the YTM tuning coil. This provides a high-impedance, constant-current source and the tuning coil can be driven by a tunable current regardless of the voltage on the tuning coil. Current in the YTM tuning coil is sensed at rear-panel resistor R5 applied as a negative-feedback voltage to U2 pin 2.

Tuning Coil Non-Linearity Compensation. Because the tuning-coil current vs frequency is non-linear, resistance is removed or added in parallel with R5 to modify the current through the tuning coil. The resistor pairs R77/80, R76/79, and R73/74 form voltage dividers to set the forward or reverse biasing voltage for CR2, CR4, and CR5. The voltage ramp at TP4 (YTM REF) provides the bias potential to switch in or out the required resistor pairs at certain frequencies in the YTM spectrum.

The factory-selected resistors, A2R60 and R65, compensate for the differences in tuning characteristics between YTM Assemblies. They provide a coarse trimming action between the voltage at TP2 and the current through the coil and, therefore, are a coarse version of the HI and LO adjustments in the Band Change Amplifier. The resistors are selected to establish the center of the range of operation for the HI and LO adjustments.

Band Three Sweep Compensation. The network of R57 and C4 provides an ac coupled impedance across the frequency-reference resistor R5. As the ramp sweeps in Band 3, the conduction of FET Q4 is adjusted by A2R55 to begin when the source is approximately 2 volts more positive than the gate. This point occurs at approximately 15 GHz or at mid range of Band 3. The FET turns ON gradually and reaches maximum conduction when the ramp is maximum negative. The RC network exponentially changes the slope of the waveform at TP4 to modify the current through the YTM tuning coil. This compensation is switched in only while sweeping above certain frequencies in Band 3 because of additional delays in the YTM magnet at higher frequencies. The COMP MAG adjust A2R57 sets the amplitude of the compensation and the COMP BREAK POINT adjust A2R55 sets the point at which Q4 begins conduction. These controls are final adjustments in Band 3 for maximum power.

Fly-Back Voltage Protection Circuit. Breakdown diode VR1 and diode CR3 provide fly-back voltage limiting at approximately −88 volts. During fly-back (retrace) or during band changes in Band 4 (sequential sweep) negative spikes of voltage are generated. These are limited to −88V by VR1 and CR2 connected to −40V.

Sequential Compensation Driver

Introduction. The prior explanations for delay compensation and offset voltages explained compensation for YTM delay characteristics only in single-band operation. In sequential sweep (Band 4), the YTM delay would require different delay compensation. To preclude adding additional compensation circuits for sequential sweep, the Sequential Compensation Driver provides in Band 4 a means of simulating single-band operation. In single band, for example Band 2, the ramp sweeps "up" in frequency and when the retrace occurs, it sweeps "down" the frequency. The YTM characteristics require this "up" and "down" excursion so the ramp always begins sweeping the frequency of the YTM from the same direction. However, in sequential sweep the ramp sweeps Band 2 and instead of a retrace there is a dwell time for 8 msec.

During this dwell time, two actions occur; the YTM is transferred into Band 3 but there is no sweep ramp as yet, and a pulse is generated that causes an action **to simulate single-band retrace.** The operation is as follows.

Adding Band 4 YTM Delay Compensation. The integrated circuit U4 contains two monostable multivibrators and associated gating circuits. With Band 4 elected, a Kick Trigger is generated as the switch-point occurs at the end of Band 2. With the YTM now in Band 3, multivibrator U4B is operating and the output pulse turns ON Q10. The pulse is adjusted between 3 to 4 ms by A2R67. With Q10 conducting, the −10V is connected to the base of Q8. The −10V overrides any action occuring at the base of Q8 and tunes the YTM for a momentary increase in frequency. The retrace transition back to the dwell time sets the YTM for the sweep of Band 3. The operation during the band switch between Bands 1 and 2 is similar except the multivibrator U4A turns ON Q9 and the pulse is 1 to 2 ms adjusted by A2R68.

TIME 2 and TIME 3 Adjustments. The TIME 2 and TIME 3 adjustments are adjusted after all compensation has been made in the single bands. The TIME 3 potentiometer A2R67 adjusts the width of the multivibrator pulse to obtain the light delay characteristics on the retrace that corresponds to the same delay characteristics that existed in single sweep. Adjusting the width of the pulse adjusts its peak and thereby sets the maximum frequency it tunes the YTM to.

Diode Bias Driver

The purpose of the diode bias driver is to provide, at a given frequency, a given current through the Step Recovery Diode (SRD) in the YIG-Tuned Multiplier A12. The inputs to U6B pin 6 determine the polarity of the offset voltage. The amplitude of the offset voltage is adjusted in Bands 2 and 3 to optimize the SRD operation for a specific harmonic. Operation is as follows.

The freqency control voltage is applied to the inverting input of amplifier U6A. The amplifier converts the positive-going 0V to 10V ramp to a 0V to −5V negative ramp. The negative ramp is applied to the source of Q6 through R37, and to the sources of Q11 (Band 2) and Q5 (Band 3). In Bands 2 and 3, HI BIAS and LO BIAS adjustments control the amplitude of the negative ramp. The outputs of the three FETs Q5, Q6, and Q11 are applied to U6B. First there is a constant positive offset voltage established by R46. There are two ramp inputs: a positive ramp from the frequency control voltage and the negative ramp from the output of either Q5, Q6 or Q11. A negative offset voltage is also coupled through either Q5 or Q11.

Band 1 Description. In Band 1, the SRD needs a negative voltage to turn ON the multiplier. This voltage is between −6V and −7V measured at TP5. The positive-going frequency control ramp cancels the negative-going ramp voltage from Q6. The remaining voltage is the positive offset due to R46. R37 is selected for minimum slope at TP5 after the two ramp voltages cancel.

Band 2 and Band 3 Description. The operation of the Diode Bias Driver in Band 2 and Band 3 are the same, except for the adjustments used; therefore, only Band 2 operation is explained here. In Band 2, the HI BIAS and LO BIAS potentiometers, R38 and R39 respectively, are adjusted to optimize the diode bias so the SRD will be rich in second harmonics. At the same time, the first and third harmonics will be minimized. (Also the YIG Filter, at the output of the step recovery diode, passes the second harmonics while rejecting the first and third harmonics.) The Band 2 LO BIAS potentiometer R39 is adjusted at the beginning of the band. It provides a negative-voltage offset to counteract the +20V from R46. Depending on how R39 is adjusted, there is either a negative or a positive offset voltage at U6B pin 6 as Band 2 begins sweeping. As Band 2 is swept, there are two slopes applied to U6B pin 6: the positive frequency control voltage through R36, and the negative ramp from Q11. Band 2 HI potentiometer R38 is adjusted to cancel the slope (ramp) from R36 or it is adjusted so the amplitude of the negative ramp is either higher or lower than the slope from R36. The diode bias output from U6B is a changing negative or positive voltage as the YTM is tuned across the band. With optimum diode bias voltage, at any given frequency there is an optimum current through the SRD. The HI BIAS and LO BIAS controls are adjusted for maximum power at the high and low ends of Band 2.

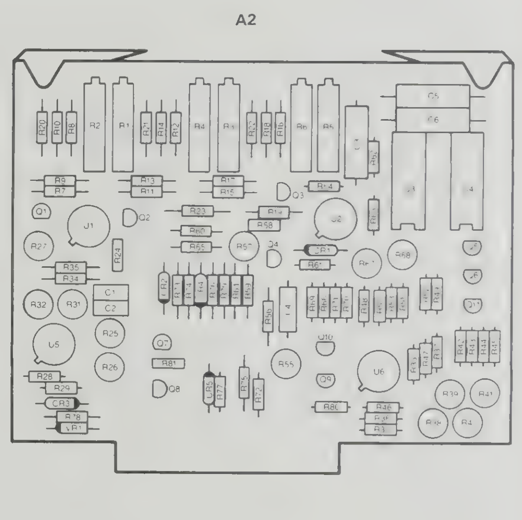


Figure 8-11. A2 YTM Driver Assembly, Component Locations

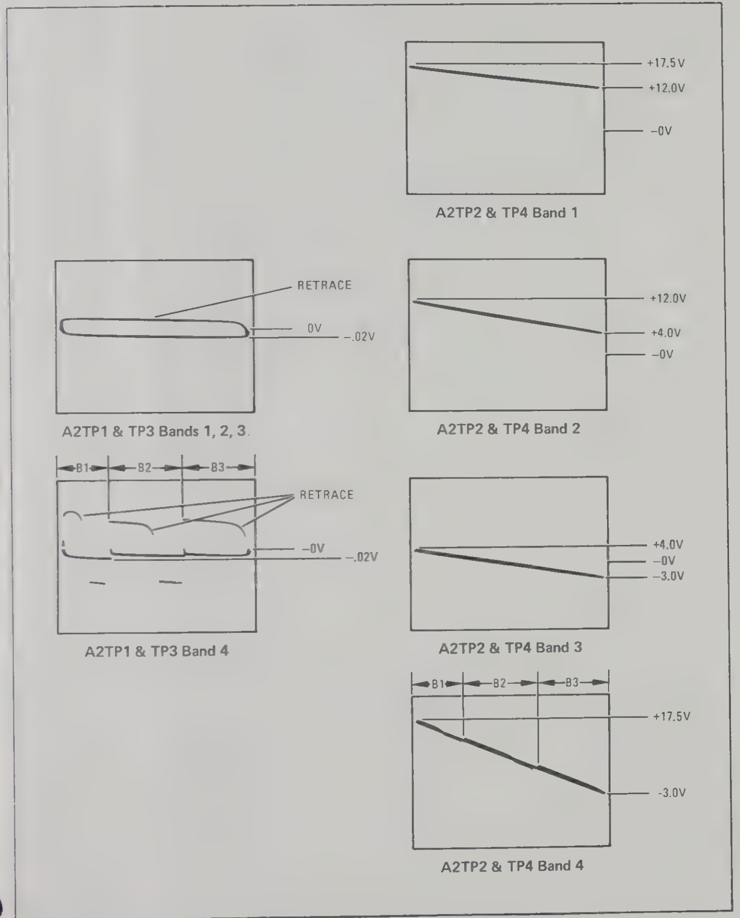


Figure 8-12. A2 YTM Driver Assembly, Waveforms (1 of 3)

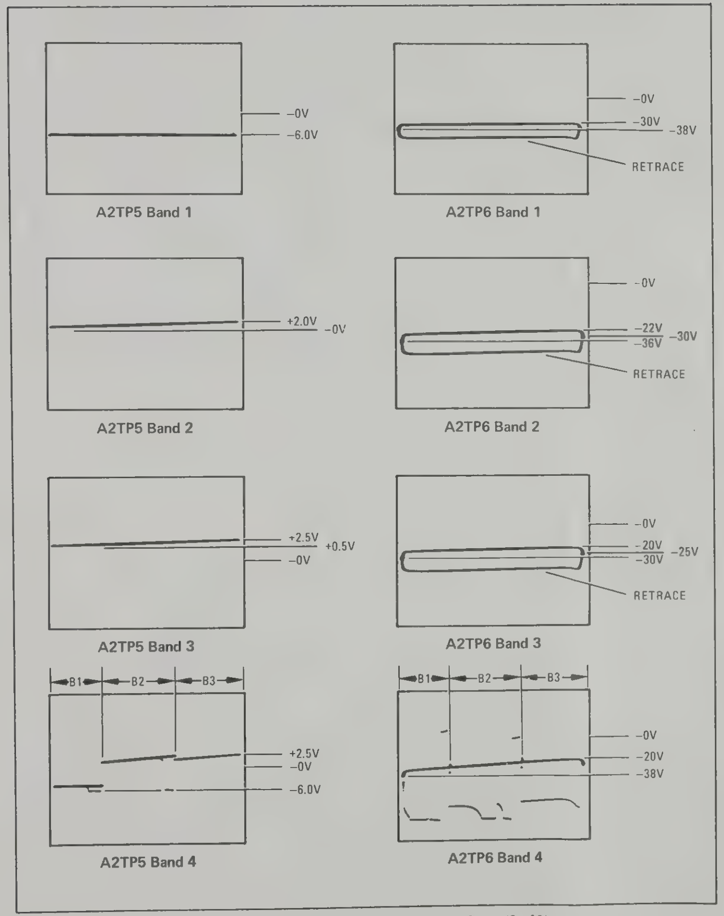


Figure 8-12. A2 YTM Driver Assembly, Waveforms (2 of 3)

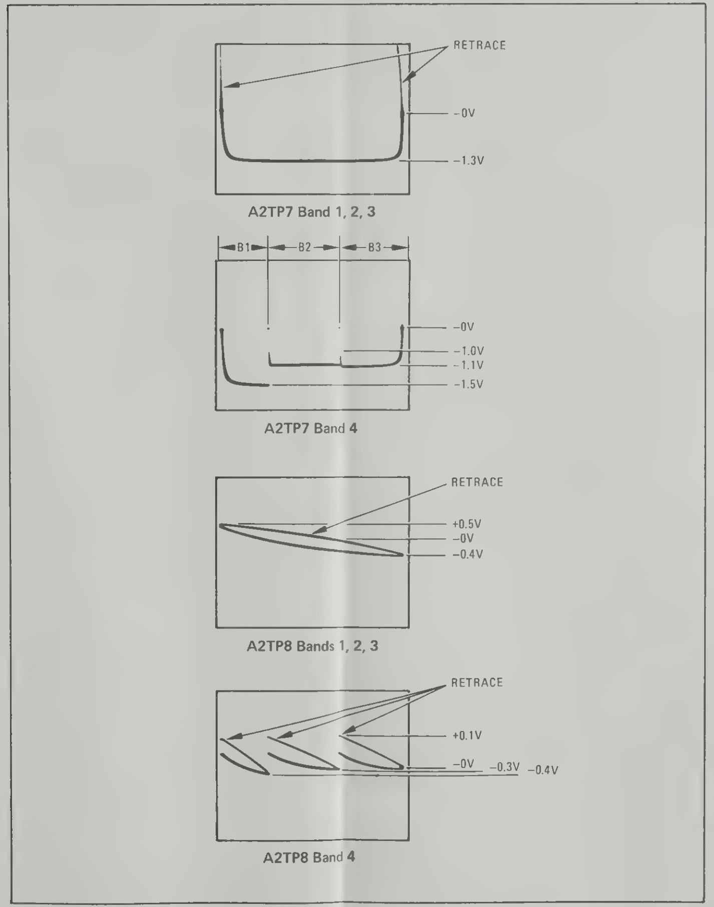
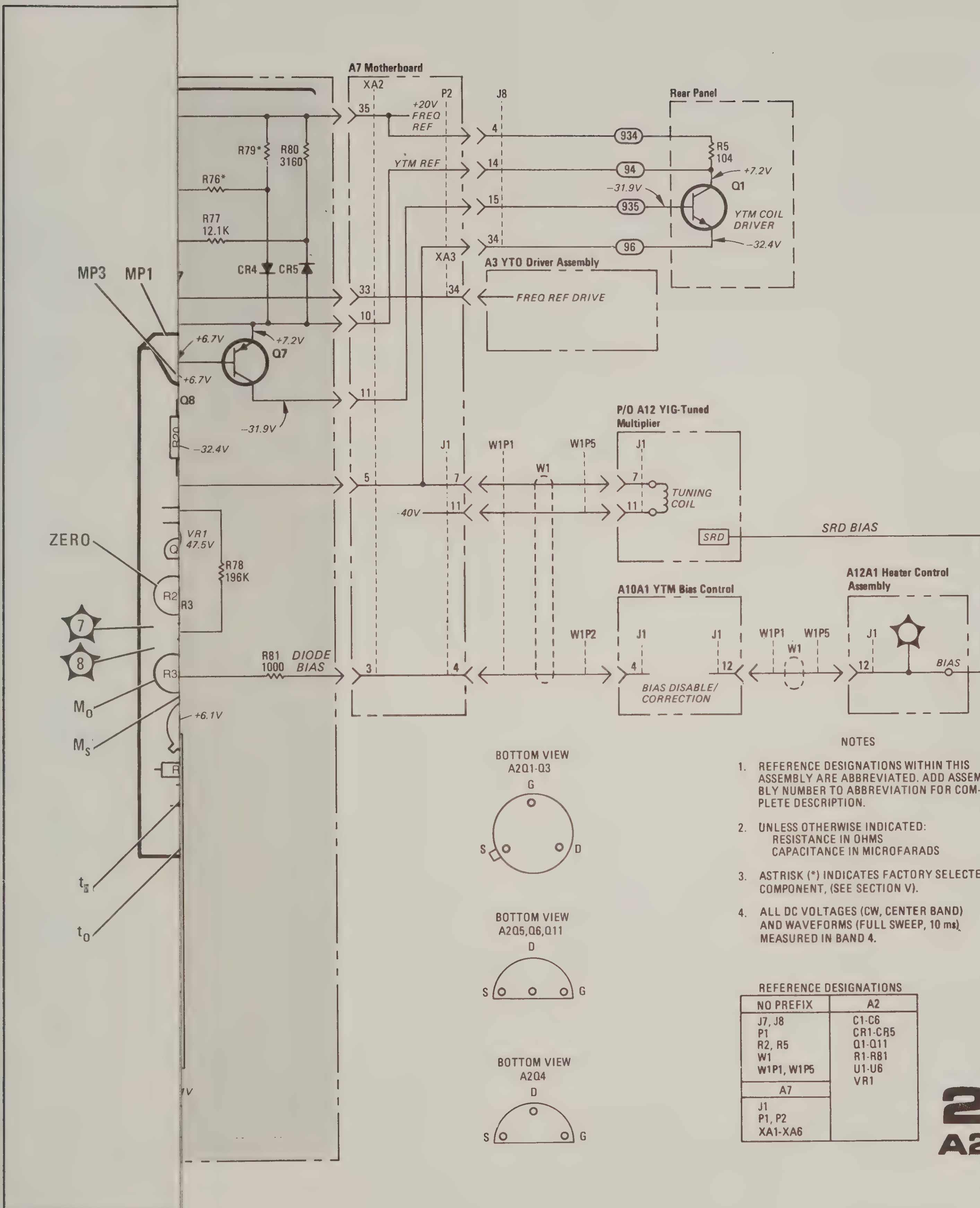


Figure 8-12. A2 YTM Driver Assembly, Waveforms (3 of 3)

Table 8-3. Voltages for A2 YTM Driver Assembly (3 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U5A-1 U5A-2 U5A-3	0 0 0	0 0 0	0 0 0
U5B-5 U5B-6 U5B-7	0 0 0	0 0 0	0 0 0
U6A-1 U6A-2 U6A-3	− 2.5 0 0	− 2.5 0 0	− 2.5 0 0
U6B-5 U6B-6 U6B-7	0 0 − 6.3	0 0 + 1.0	0 0 + 1.4



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
3. ASTRISK (*) INDICATES FACTORY SELECTED COMPONENT, (SEE SECTION V).
4. ALL DC VOLTAGES (CW, CENTER BAND) AND WAVEFORMS (FULL SWEEP, 10 ms) MEASURED IN BAND 4.

REFERENCE DESIGNATIONS

NO PREFIX	A2
J7, J8 P1 R2, R5 W1 W1P1, W1P5	C1-C6 CR1-CR5 Q1-Q11 R1-R81 U1-U6 VR1
A7	
J1 P1, P2 XA1-XA6	

Fig

Figure 8-14. A2 YTM Driver Assembly, Schematic

Table 8-3. Voltages for A2 YTM Driver Assembly (1 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	+14.7	+ 8.2	+ 0.8
TP3	0	0	0
TP4	+14.7	+ 8.2	+ 0.8
TP5	− 6.3	+ 1.0	+ 1.4
TP6	−36.9	−33.0	−28.5
TP7	0	0	0
TP8	0	0	0
Q1-S	0	− 1.2	− 2.6
Q1-G	0	+10.2	+10.2
Q1-D	0	0	0
Q2-S	+ 0.9	0	− 1.1
Q2-G	+ 9.3	0	+ 9.3
Q2-D	0	0	0
Q3-S	+ 1.7	+ 0.9	0
Q3-G	+ 9.3	+ 9.3	0
Q3-D	0	0	0
Q4-S	+14.7	+ 8.2	+ 0.8
Q4-G	− 3.3	− 3.3	− 3.3
Q4-D	+ 0.4	+ 0.3	+ 0.2
Q5-S	− 5.7	− 5.7	− 0.1
Q5-G	+ 9.3	+ 9.3	0
Q5-D	0	0	0
Q6-S	0	− 2.5	− 2.5
Q6-G	0	+10.2	+10.2
Q6-D	0	0	0
Q7-E	+14.7	+ 8.2	+ 0.8
Q7-B	+14.2	− 7.7	+ 0.3
Q7-C	−36.4	−32.5	−27.8
Q8-E	+14.2	+ 7.7	+ 0.3
Q8-B	+13.7	+ 7.2	+ 0.3
Q8-C	−36.9	−33.0	−28.4
Q9-E	− 9.9	− 9.9	− 9.9
Q9-B	−11.1	−11.1	−11.1
Q9-C	+13.7	+ 7.1	− 0.3

Table 8-3. Voltages for A2 YTM Driver Assembly (2 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
Q10-E	− 9.9	− 9.9	− 9.9
Q10-B	−11.2	−11.2	−11.2
Q10-C	+13.7	+ 7.1	− 0.3
Q11-S	− 5.4	− 0.2	− 5.4
Q11-G	+ 9.3	0	+ 9.3
Q11-D	0	0	0
Q1-E	−36.9	−33.0	−28.4
Q1-B	−36.4	32.5	−27.8
Q1-C	+14.7	+ 8.2	+ 0.8
U1-2	0	0	0
U1-3	0	0	0
U1-6	+14.7	+ 8.2	+ 0.8
U2-2	+14.7	+ 8.2	+ 0.8
U2-3	+14.7	+ 8.2	+ 0.8
U2-6	+13.7	+ 7.1	− 0.3
U3A-2	+ 4.9	+ 4.9	+ 4.9
U3A-3	+ 0.1	+ 0.1	+ 0.1
U3B-4	+ 4.9	+ 4.9	+ 4.9
U3B-5	+ 0.1	+ 0.1	+ 0.1
U3C-6	0	0	+ 4.9
U3C-7	+ 4.6	+ 4.6	0
U3D-9	+ 4.4	+ 4.4	+ 4.4
U3D-10	0	0	0
U3E-11	+ 4.3	+ 4.3	+ 4.3
U3E-12	0	0	0
U3F-14	+ 4.6	0	+ 4.6
U3F-15	0	+ 4.9	0
U4-1,9	+ 4.9	+ 4.9	+ 4.9
U4-2	0	+ 4.9	0
U4-3,11	+ 4.9	+ 4.9	+ 4.9
U4-4	+ 4.4	+ 4.4	+ 4.4
U4-6	+ 1.6	+ 1.6	+ 1.6
U4-7	+ 1.3	+ 1.3	+ 1.3
U4-10	0	0	+ 4.9
U4-12	+ 4.3	+ 4.3	+ 4.3
U4-14	+ 1.6	+ 1.6	+ 1.6
U4-15	+ 1.4	+ 1.4	+ 1.4

Table 8-3. Voltages for A2 YTM Driver Assembly (3 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U5A-1	0	0	0
U5A-2	0	0	0
U5A-3	0	0	0
U5B-5	0	0	0
U5B-6	0	0	0
U5B-7	0	0	0
U6A-1	− 2.5	− 2.5	− 2.5
U6A-2	0	0	0
U6A-3	0	0	0
U6B-5	0	0	0
U6B-6	0	0	0
U6B-7	− 6.3	+ 1.0	+ 1.4

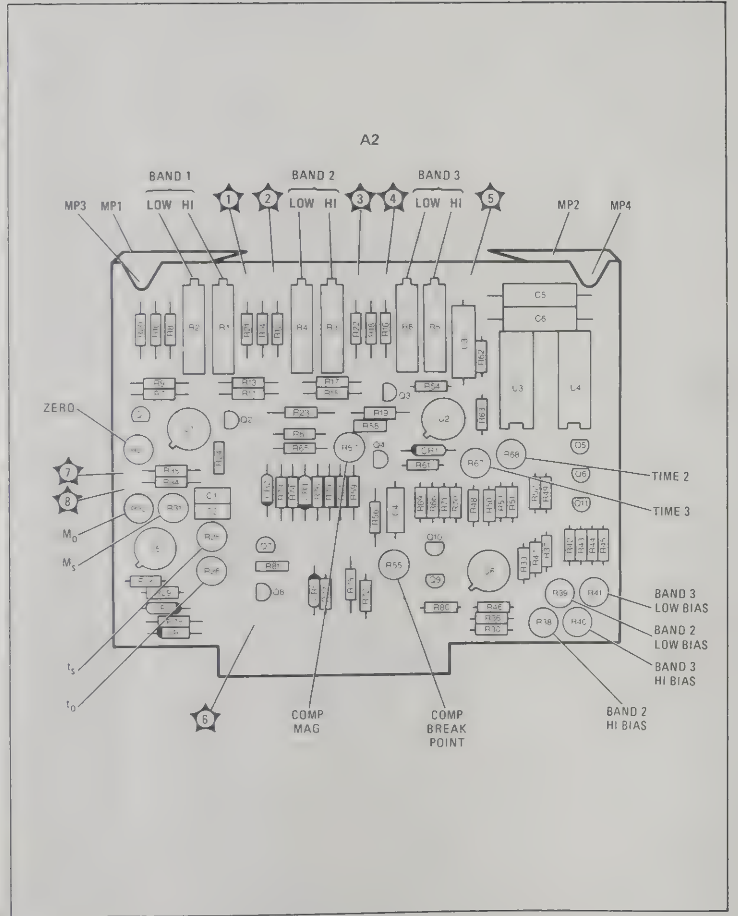


Figure 8-13. A2 YTM Driver Assembly, Test Points and Adjustment Locations

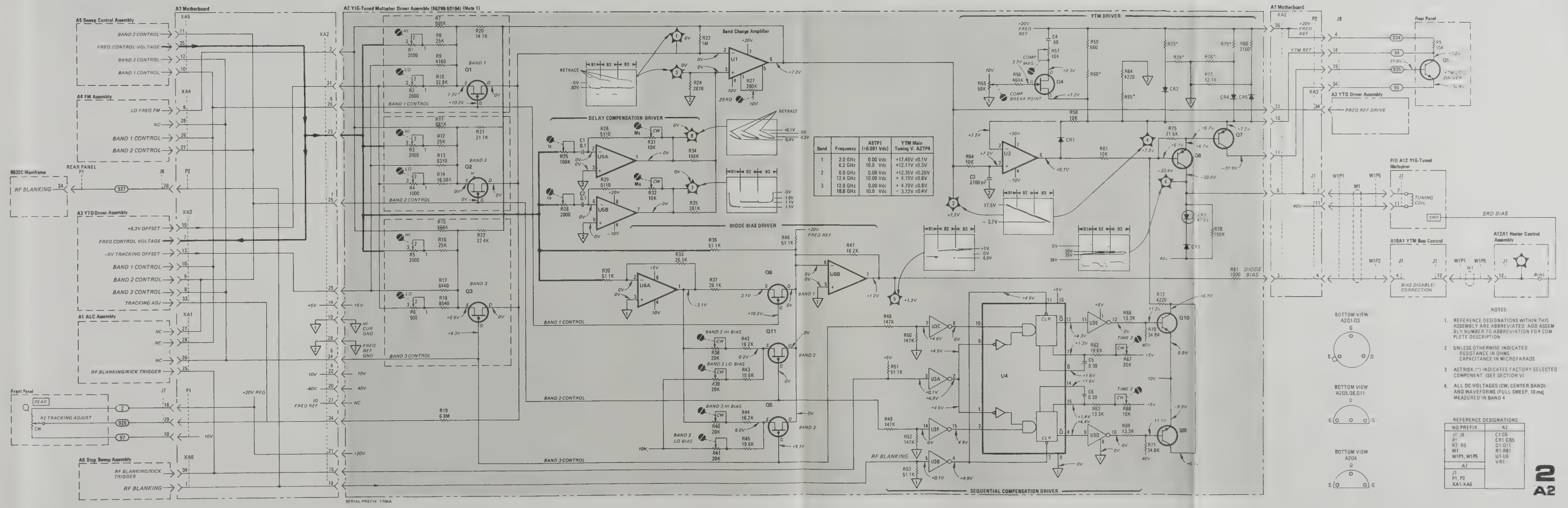


Figure 8-14. A2 YTM Driver Assembly, Schematic

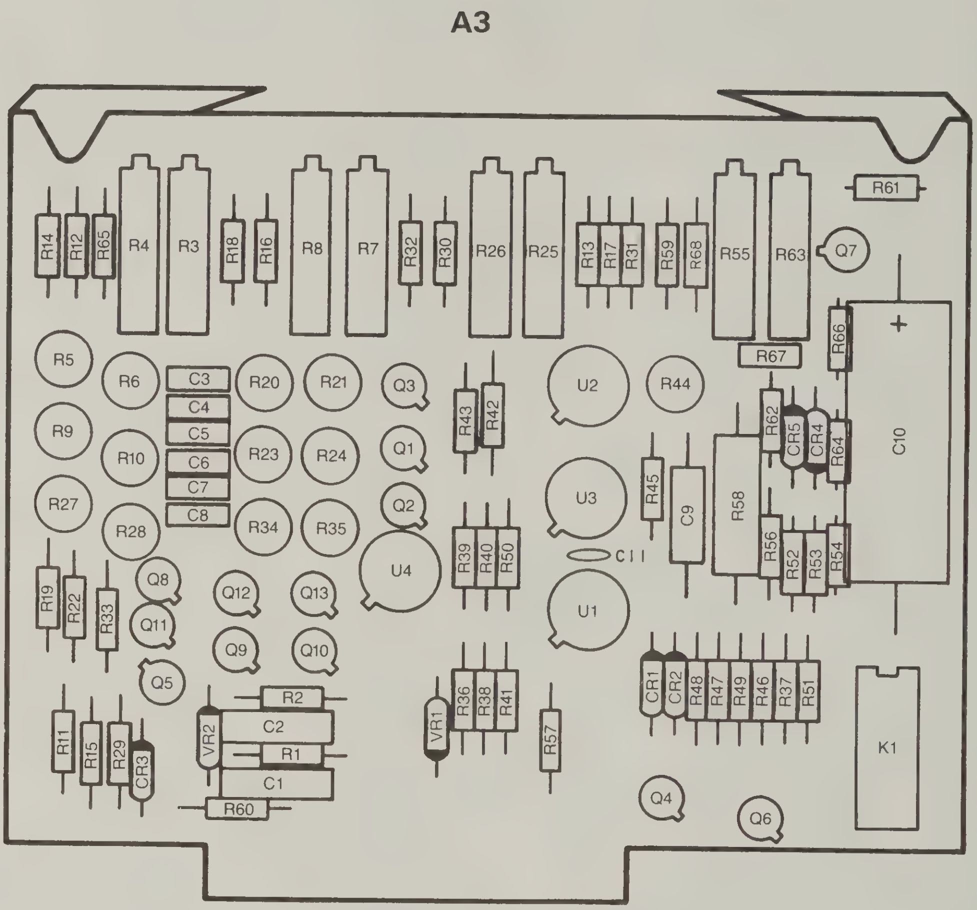
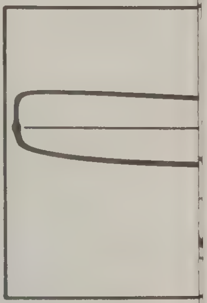
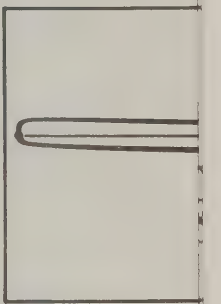


Figure 8-15. A3 YTO Driver Assembly, Component Locations

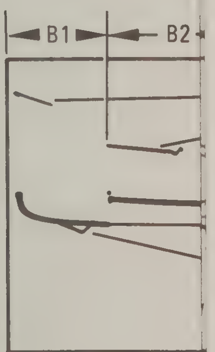


A3TP1, T



A3TP1, T

A3TP1, T



A3TP1, T

SERVICE SHEET 3

A3 YTO DRIVER ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A3 YTO Driver Assembly has three major functions: 1) to control the frequency of the YTO by driving the required current through the tuning coil, 2) to provide a −0.6V offset voltage for use by both the YTO and YTM YIG Driver Band Change Amplifiers, and 3) to provide the rear-panel 1V/GHz Frequency Reference output.

The input to the YIG Driver circuit is a 0 to 10V frequency control voltage (FCV) from the A5 SWEEP CONTROL Assembly. The Band Change Amplifier U2 receives the FCV, amplifies it, and inverts it to a negative going ramp. The amplitude of the ramp will be determined by which band is selected. Selecting different bands changes the gain by switching the input resistance and the feedback resistance of U2.

The delay compensation signals developed by U4A and U4B are summed with the FCV at U2. The delay signal amplitude or shape will depend on which band is selected, as again the input and feedback resistances for both U4A and U4B are switched as the different bands are selected.

The Current Driver U3A, rear-panel-mounted Reference Resistor R2, +20V FREQUENCY REFERENCE, plus the voltage applied to U3A determines the current in the YTO tuning coil.

Offset Voltage Driver

The −6.0V tracking offset voltage is referenced to the +20V FREQUENCY REFERENCE voltage. The output is inversely proportional to the +20V FREQUENCY REFERENCE voltage. This is used as a correction voltage to maintain frequency accuracy independent of the +20V FREQUENCY REFERENCE voltage. Any change in the level of the +20V FREQUENCY REFERENCE voltage applied to the reference resistor would normally cause a current change in the YTO YIG coil; however, the −6.0V corrects for any change in the +20V FREQUENCY REFERENCE voltage to maintain a constant current through the YIG coil.

When the different bands are selected, the feedback, input, and offset resistances are also selected. The Frequency Control Voltage is a 0 to +10V positive going ramp for full-band sweep. The ramp is summed with the two offset voltages, +6.3V and −6.0V. The +6.3V is derived from the +20V with a 6.3V zener diode VR1 and is also used on the A2YTM Driver Assembly. The −6.0V is a nominal voltage that is referenced to the +20V FREQUENCY REFERENCE voltage and is also used on the A2YTM Driver Assembly.

YTO Current Driver

The YTO Current Driver circuit consists of U3A, a voltage follower amplifier, Q5, Q4, chassis-mounted Q2, and R2, the 155 ohm Reference Resistor. Transistors Q5 and Q4 are in the feedback path and provide drive current for Q2. The voltage at TP4 is the same as that applied at the non-inverting input of U3A. Therefore, as the input voltage changes, the current through the reference resistor must change to maintain voltage at TP4 equal to input voltage.

Resistor R59 shunts the Reference Resistor and is factory-selected to coarse set the frequency. It is used to compensate for the tuning sensitivity variations between YTOs. Resistors R46 through R49 are also factory-selected to compensate for non-linearity in the YIG tuning coils. The actual values used for each instrument are recorded on a label on the RF casting. The A9 YTO Assembly and the A3 YTO Driver Assembly must be replaced together. Should one of them fail, a new label is supplied with the replacement assemblies and should be placed on the RF casting. The correct resistors are installed in the new A3 YTO Driver Assembly.

A 196K ohm resistor in parallel with the YIG tuning coil is used to damp out ringing. Diodes VR2 and CR3 are used to protect the drive transistor from the large back EMF from the tuning coil. Capacitor C10 is connected in parallel with the YIG coil when CW or MANUAL sweep is selected as a filter to reduce residual FM.

Delay Compensation

For each op-amp, there are three sets of input and feedback resistances that can be switched in and adjusted depending on the band selected. The delay compensation for Band 2 is set at the factory with special electronic tooling to match the A9 YTO Assembly installed. The adjustments are then sealed. No attempt should be made to readjust them. It is for this reason that the A9 YTO Assembly and the AC YTO Driver Assembly must be replaced together.

The input resistance, and the capacitor in series, forms a differentiator. The input resistance will determine the magnitude of the signal out and the feedback resistance determines its time constant.

Frequency Reference Voltage Driver

The output voltage of the rear-panel FREQ REF connector is 1 V/GHz. This can be used by external equipment as a frequency indicator. The input is a +18.5V to −3.7V ramp from the A2 YTM Assembly Band Change Amplifier. The +18.5V corresponds to 2.0 GHz, and −3.7V corresponds to 18.6 GHz. Resistors R52, R53, and R54 form a voltage divider between the input and −10V. The voltage at the junction of R52, R53, and R56 will be approximately zero volts when the input is at +18.5V, thus no current flow in R56. The voltage at the output can be adjusted with C control R63.

The voltage is adjusted slightly with the front-panel PEAK control to track the frequency change that the same control causes at the YTM. Transistors Q7A and Q7B act as a constant source to cause a constant voltage at the output of U3B. The offset is necessary to prevent U3B from saturating; Q7A is connected as a diode between the +20V supply and ground through R67. There is approximately 1.3 ma of current flowing through R67. Since the emitters and the bases of Q7A and Q7B are connected together, there will also be 1.3 ma through Q7B. This 1.3 ma must so flow through R64, thus causing a 5.0V drop across it. Therefore, the output of U3B is 5.0V lower than the Frequency Reference voltage.

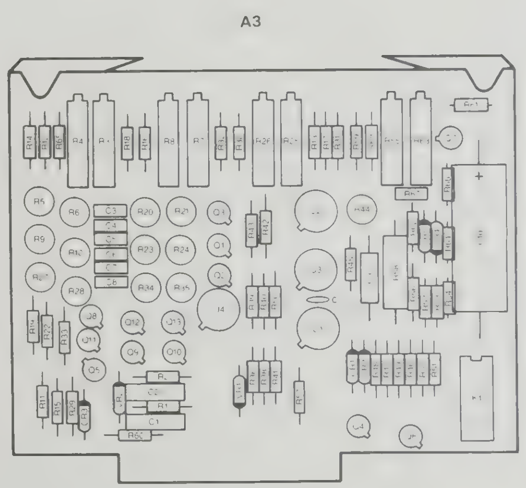


Figure 8-15. A3 YTO Driver Assembly, Component Locations

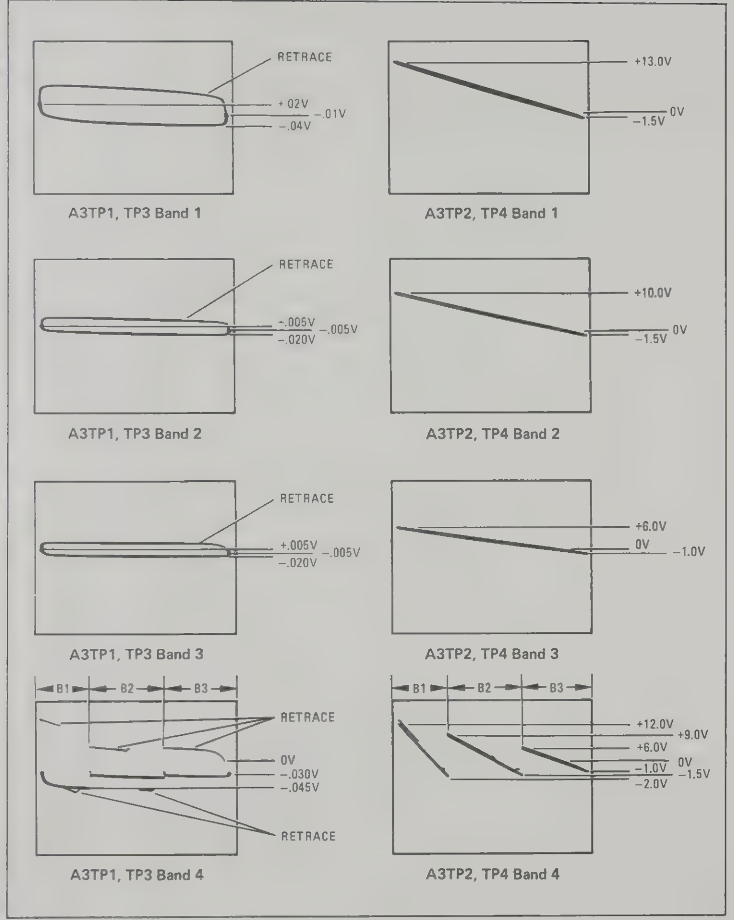


Figure 8-16. A3 YTO Driver Assembly, Waveforms (1 of 2)

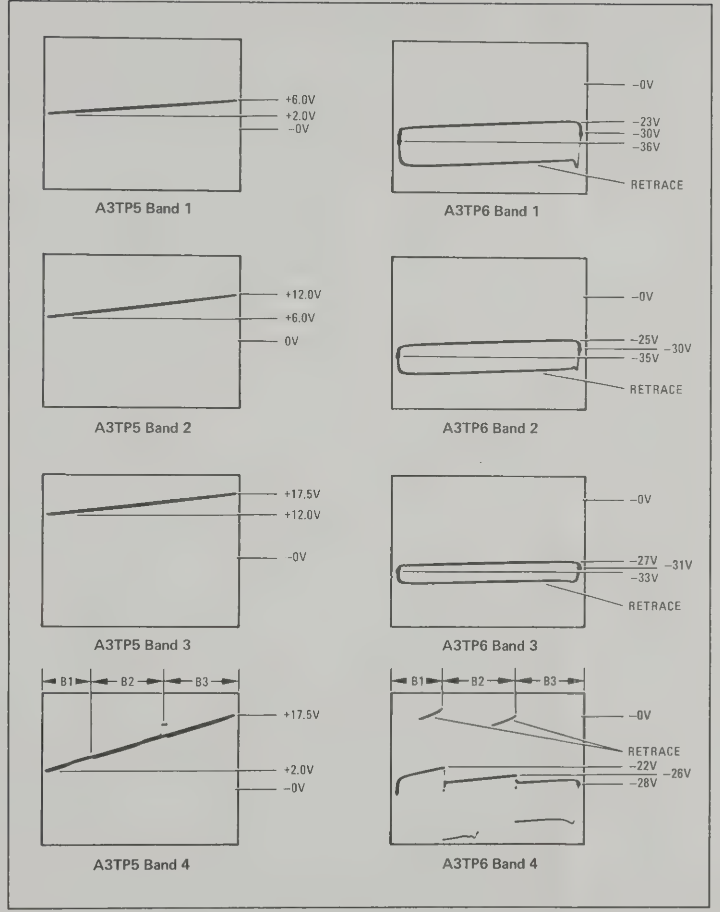
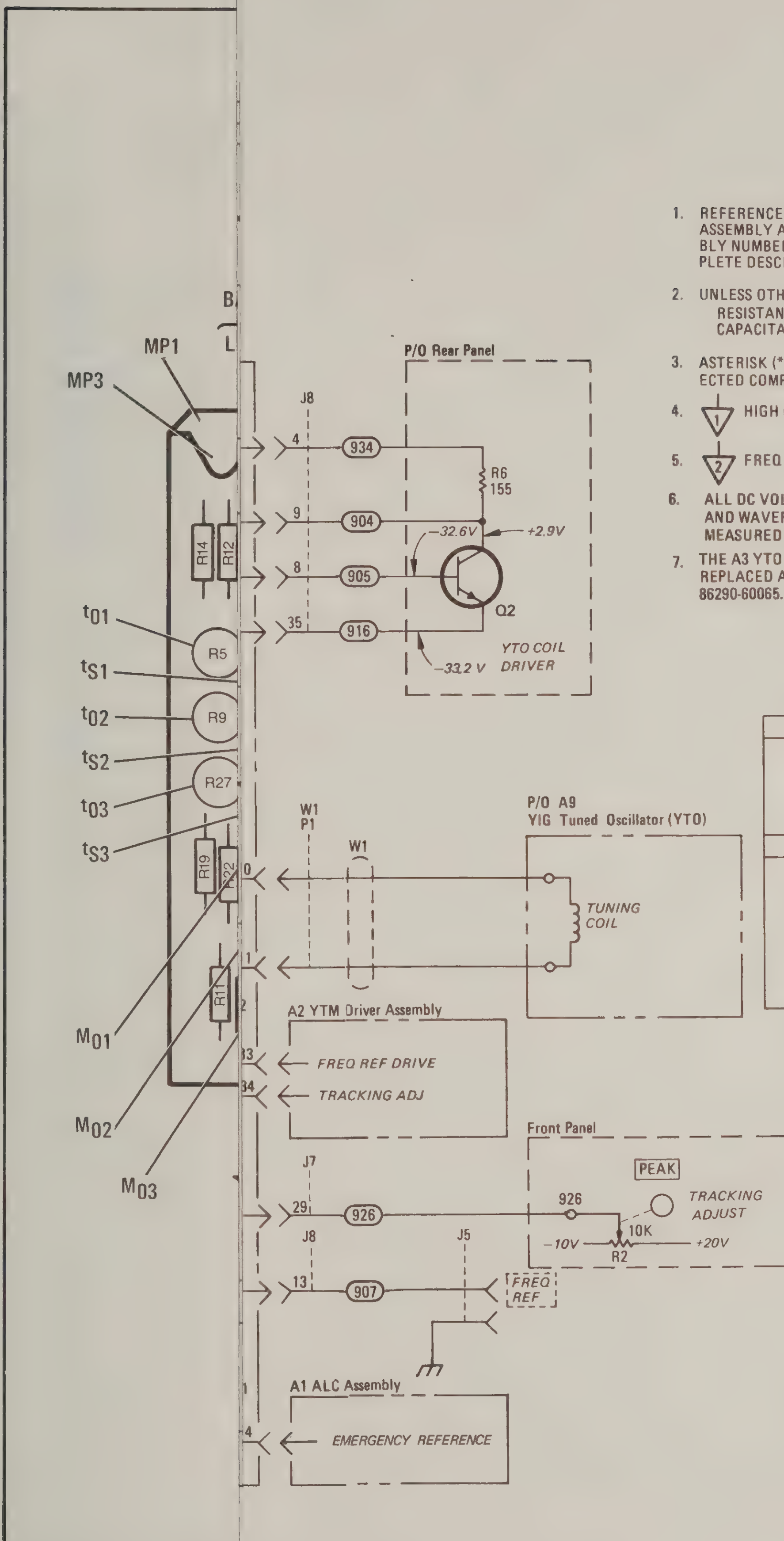


Figure 8-16. A3 YTO Driver Assembly, Waveforms (2 of 2)

Table 8-4. Voltages for A3 YTO Driver Assembly, (2 of 2)

Test Point	Voltages		
	Band 1 (Vdc)	**Band 2 (Vdc)**	**Band 3 (Vdc)**
Q10-S Q10-G Q10-D	0 + 9.3 0	0 + 9.3 0	0 0 0
Q11-S Q11-G Q11-D	0 0 0	0 +10.2 0	0 +10.2 0
Q12-S Q12-G Q12-D	0 + 9.3 0	0 0 0	0 + 9.3 0
Q13-S Q13-G Q13-D	0 + 9.3 0	0 + 9.3 0	0 0 0
Q2-E Q2-B Q2-C	−34.5 −33.9 + 5.9	−33.8 −33.2 + 4.2	−33.2 −32.6 + 2.8
U1-2 U1-3 U1-6	0 0 − 6.0	0 0 − 6.0	0 0 − 6.0
U2-2 U2-3 U2-6	0 0 + 5.9	0 0 + 4.2	0 0 + 3.5
U3A-1 U3A-2 U3A-3	+ 4.8 + 5.9 + 5.9	+ 3.1 + 4.2 + 4.2	+ 1.7 + 3.5 + 3.5
U3B-5 U3B-6 U3B-7	0 0 − 1.5	0 0 + 4.1	0 0 +10.5
U4A-1 U4A-2 U4A-3	0 0 0	0 0 0	0 0 0
U4B-5 U4B-6 U4B-7	0 0 0	0 0 0	0 0 0

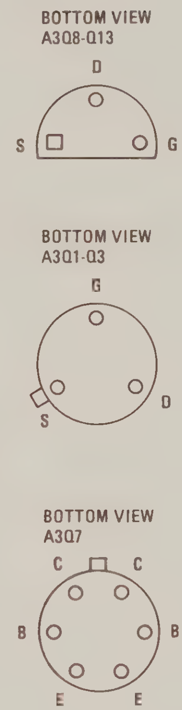


NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. ASTERISK (*) INDICATES FACTORY SELECTED COMPONENT. SEE SECTION V.
4. HIGH CURRENT GROUND
5. FREQ REF GROUND
6. ALL DC VOLTAGES (CW, CENTER BAND) AND WAVEFORMS (FULL SWEEP, 10 ms) MEASURED IN BAND 4.
7. THE A3 YTO DRIVER AND A9 YTO ARE REPLACED AS ONE UNIT; HP PART NO. 86290-60065.

REFERENCE DESIGNATIONS

NO PREFIX	A7
J5,7,8 Q2 R2, R6 W1 W1P1	J1 P1, P2 XA1 – XA5
A3	
C1 – 10 CR1 – 5 K1 Q1 – 13 R1 – 67 TP1 – 6 U1 – 4 VR1, 2	



3
A3

Figure 8-18. A3 YTO Driver Assembly, Schematic

Table 8-4. Voltages for A3 YTO Driver Assembly, (1 of 2)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	+ 5.9	+ 4.2	+ 3.5
TP3	0	0	0
TP4	+ 5.9	+ 4.2	+ 3.5
TP5	+ 4.0	+ 9.1	+15.3
TP6	−34.5	−33.8	−32.6
Q1-S	0	0.3	− 0.4
Q1-G	0	+10.2	+10.2
Q1-D	0	0	0
Q2-S	+ 0.2	0	− 0.2
Q2-G	+ 9.3	0	+ 9.3
Q2-D	0	0	0
Q3-S	+ 0.4	+ 0.2	0
Q3-G	+ 9.3	+ 9.3	0
Q3-D	0	0	0
Q4-E	+ 5.9	+ 4.2	+ 3.5
Q4-B	+ 5.4	+ 3.7	+ 2.3
Q4-C	−33.9	−33.2	−32.6
Q5-E	+ 5.4	+ 3.7	+ 2.3
Q5-B	+ 4.9	+ 3.2	+ 1.8
Q5-C	−34.5	−33.8	−33.2
Q6-E	+ 4.1	+ 9.2	+15.1
Q6-B	+ 4.1	+ 9.9	+15.7
Q6-C	+19.7	+19.7	+19.7
Q7A-E	+19.7	+19.7	+19.7
Q7A-B	+19.0	+19.0	+19.0
Q7A-C	+ 4.7	+ 9.9	+15.7
Q7B-E	+19.7	+19.7	+19.7
Q7B-B	+19.0	+19.0	+19.0
Q7B-C	+19.0	+19.0	+19.0
Q8-S	0	0	0
Q8-G	0	+10.2	+10.2
Q8-D	0	0	0
Q9-S	0	0	0
Q9-G	+ 9.3	0	+ 9.3
Q9-D	0	0	0

Table 8-4. Voltages for A3 YTO Driver Assembly, (2 of 2)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
Q10-S	0	0	0
Q10-G	+ 9.3	+ 9.3	0
Q10-D	0	0	0
Q11-S	0	0	0
Q11-G	0	+10.2	+10.2
Q11-D	0	0	0
Q12-S	0	0	0
Q12-G	+ 9.3	0	+ 9.3
Q12-D	0	0	0
Q13-S	0	0	0
Q13-G	+ 9.3	+ 9.3	0
Q13-D	0	0	0
Q2-E	−34.5	−33.8	−33.2
Q2-B	−33.9	−33.2	−32.6
Q2-C	+ 5.9	+ 4.2	+ 2.8
U1-2	0	0	0
U1-3	0	0	0
U1-6	− 6.0	− 6.0	− 6.0
U2-2	0	0	0
U2-3	0	0	0
U2-6	+ 5.9	+ 4.2	+ 3.5
U3A-1	+ 4.8	+ 3.1	+ 1.7
U3A-2	+ 5.9	+ 4.2	+ 3.5
U3A-3	+ 5.9	+ 4.2	+ 3.5
U3B-5	0	0	0
U3B-6	0	0	0
U3B-7	− 1.5	+ 4.1	+10.5
U4A-1	0	0	0
U4A-2	0	0	0
U4A-3	0	0	0
U4B-5	0	0	0
U4B-6	0	0	0
U4B-7	0	0	0

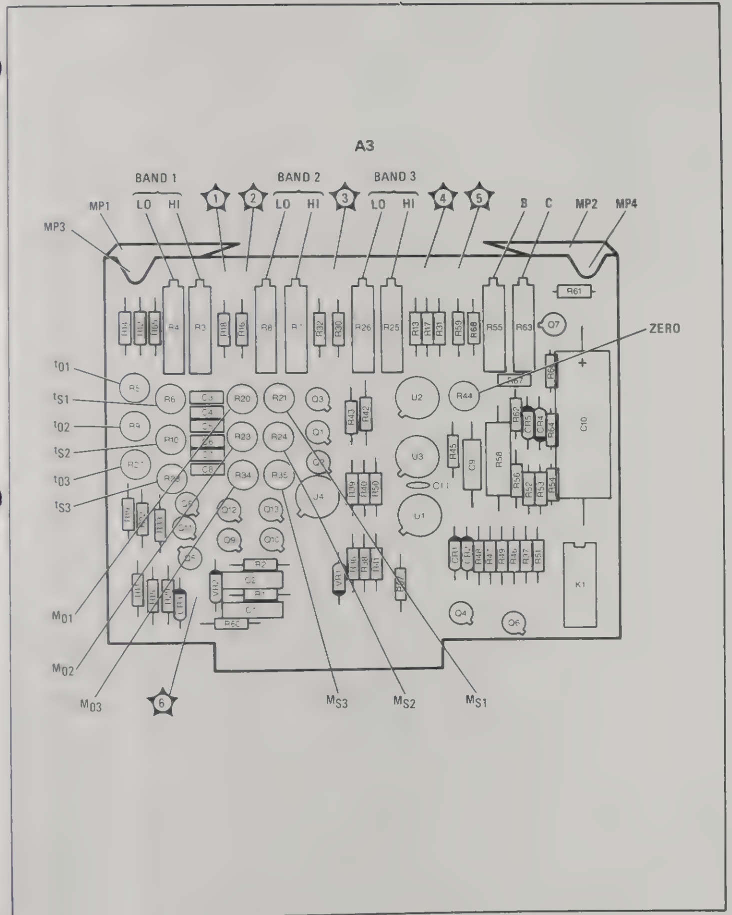


Figure 8-17. A3 YTO Driver Assembly, Test Points and Adjustment Locations

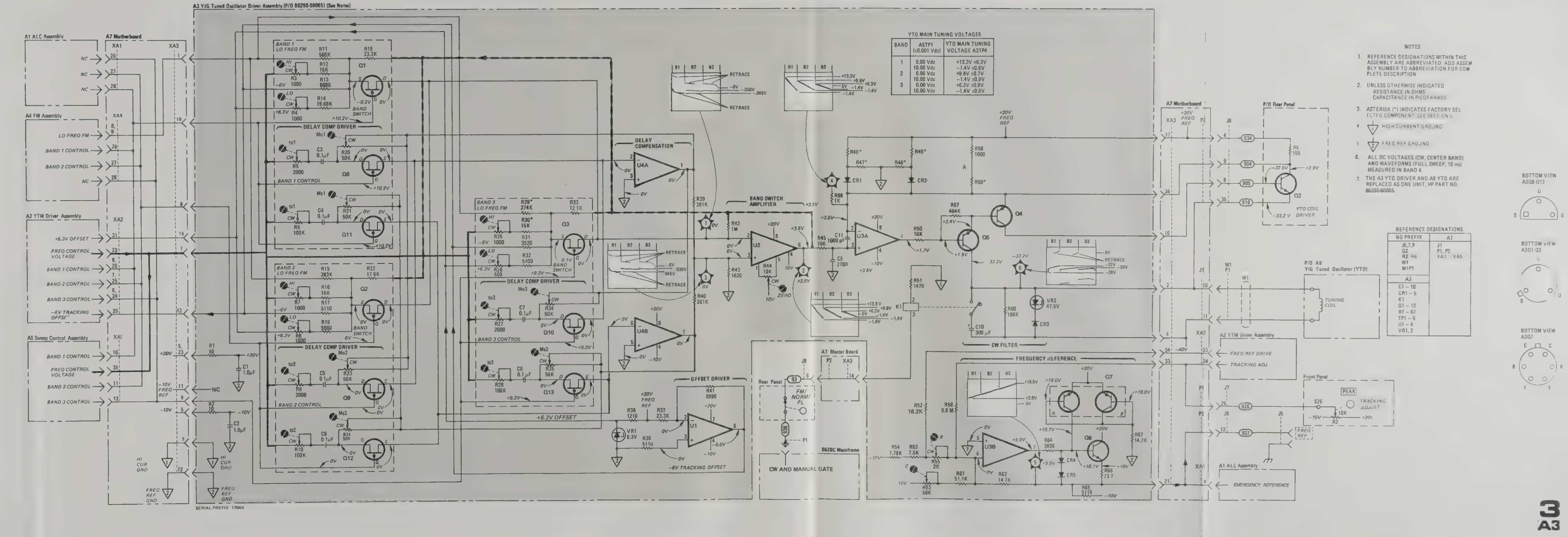
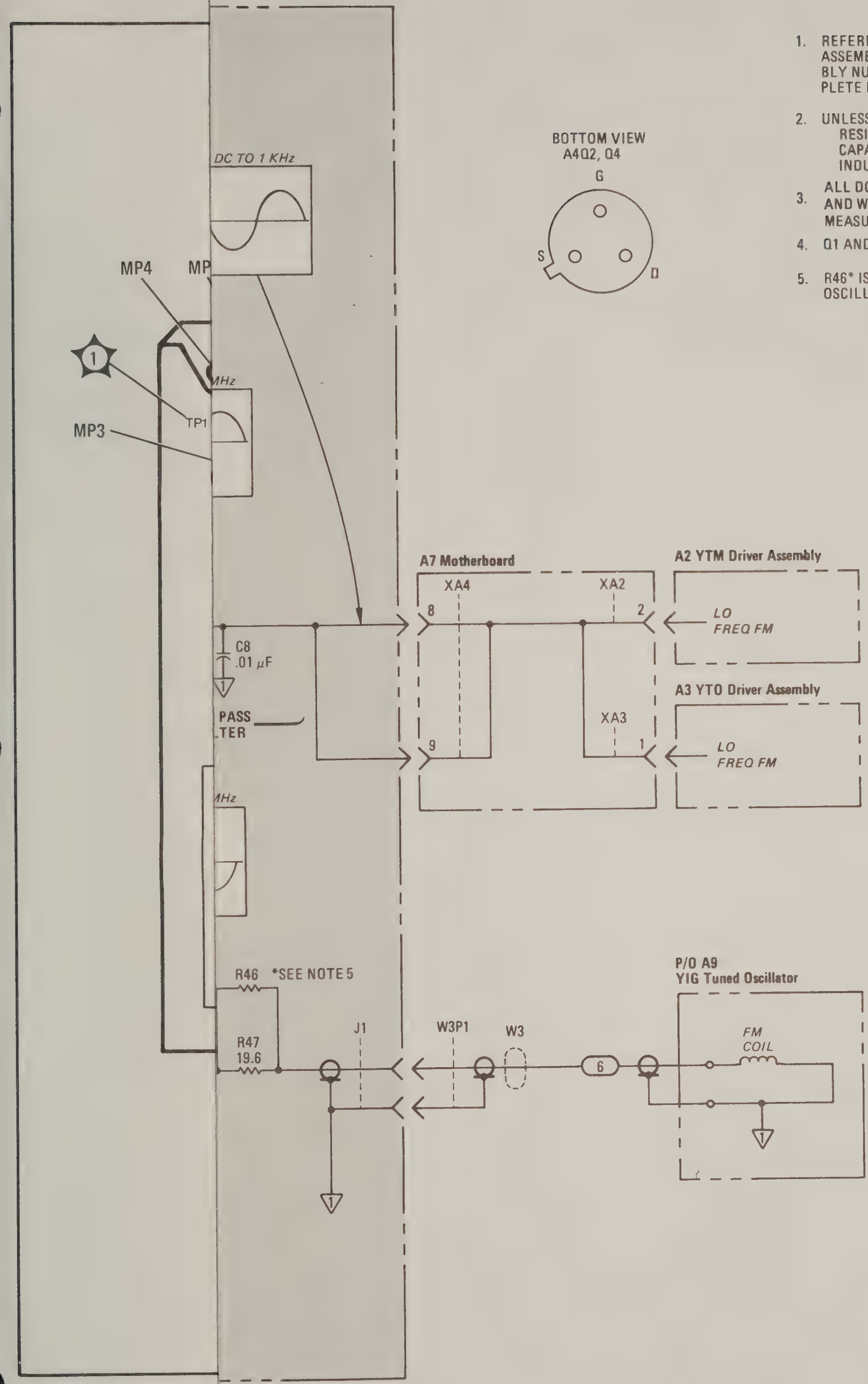


Figure 8-18. A3 YTO Driver Assembly, Schematic

Table 8-5. Voltages for A4 Frequency Modulation Assembly

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	0	0	0
TP3	+ 0.6	+ 0.6	+ 0.6
TP4	GND	GND	GND
Q1-E	− 0.6	− 0.6	− 0.6
Q1-B	0	0	0
Q1-C	+14.9	+14.9	+14.9
Q2-S	0	0	0
Q2-G	0	+10.2	+10.2
Q2-D	0	0	0
Q3-E	− 0.6	− 0.6	− 0.6
Q3-B	0	0	0
Q3-C	+14.6	+14.6	+14.6
Q4-S	0	0	0
Q4-G	+ 9.3	0	+ 9.3
Q4-D	0	0	0
Q5-E	+15.2	+15.2	+15.2
Q5-B	+14.6	+14.6	+14.6
Q5-C	+ 0.6	+ 0.6	+ 0.6
Q6-E	0	+ 0.4	+ 0.6
Q6-B	+ 0.6	+ 0.6	+ 0.6
Q6-C	+16.2	+16.2	+16.2
Q7-E	+12.0	+12.0	+12.0
Q7-B	+11.4	+11.4	+11.4
Q7-C	+ 0.4	+ 0.4	+ 0.4
Q8-E	+ 0.6	+ 0.6	+ 0.6
Q8-B	+ 0.4	+ 0.4	+ 0.4
Q8-C	+ 9.7	+ 9.7	+ 9.7
Q9-E	+ 0.6	+ 0.6	+ 0.6
Q9-B	+ 1.2	+ 1.2	+ 1.2
Q9-C	+19.3	+19.3	+19.3
Q10-E	+ 0.5	+ 0.5	+ 0.5
Q10-B	+ 0.1	+ 0.1	+ 0.1
Q10-C	− 9.8	− 9.8	− 9.8
U1-2	0	0	0
U1-3	0	0	0
U1-6	0	0	0



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES.
3. ALL DC VOLTAGES (CW, CENTER BAND) AND WAVEFORMS (FULL SWEEP, 10 ms) MEASURED IN BAND 4.
4. Q1 AND Q3 HAVE A COMMON HEAT SINK.
5. R46* IS FACTORY SELECTED TO MATCH YIG OSCILLATOR FM SENSITIVITY.

SENSITIVITY KHZ/MA	VALUE FOR R46 IN OHMS
150 – 175	13.3
175 – 200	21.5
200 – 225	31.6
225 – 250	51.1
250 – 275	100
275 – 300	316

REFERENCE DESIGNATIONS

NO PREFIX	A4
	C1 – 8
	CR1 – 4
J4, 8	J1
	K1
S3	L1 – 4
W3	Q1 – 10
	R1 – 47
	U1

4

A4

Figure 8-20. A4 Assembly, Schematic

SERVICE SHEET 4

A4 FM ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A4FM Assembly receives the signal applied to the 86290B rear-panel FM input connector, amplifies it, and routes it to either the A2 YTM and A3 YTO Drivers or to the YTO FM coil, depending on the frequency of the signal applied. For frequencies of 1,000 cycles and below, the signal goes to the YIG Drives Assemblies. For signals 1,000 cycles and above, the signal goes to the YTO FM coil.

The gain of the first stage is changed for Phase-Lock (PL) operation to give an over-all response of −6 MHz/Volt. For FM and normal operation the sensitivity is −20 MHz/Volt.

To maintain a flat response for all bands, the gain of the second stage is changed for each band. This is necessary to match the gain changes in the YIG Drivers that occur for the different bands.

The higher frequency FM goes through an additional amplifier and FM coil driver circuit.

FM Amplifier

The first stage is a buffer amplifier, the gain of which is set by the voltage divider at the input. In NORMAL and FM operation, the gain is .66. For PL operation, the gain is .2.

The remainder of the circuit is an operational amplifier. The discrete components are used for frequency response. The input resistance for Band 3 is R11 (3.16K) and the feedback resistance is 3.16K for low frequencies producing a gain of −1. For Band 1 the input resistance is R9 in parallel with the R11 or 936 ohms. This changes the gain to 3.3. For Band 2 operation the input resistance is R10 in parallel with R11 or 2.0K for a gain of 1.6.

The balance adjust BAL R13 is used to set the output to zero volts with no input at FM connector.

The feedback has gain shaping. The 360 mH coil impedance at low frequency is very low, shunting R41 (3.83K). As the frequency approaches 1.74 MHz the impedance increases to 3.83K increasing the feedback resistance and raising the gain. The gain increase compensates for roll-off in the YTO FM coil. Resistor R45 and Capacitator C8 form a low-pass filter that rolls off at 2kHz. This allows only those frequencies below 2 kHz to pass to the YTO and YTM driver boards. The high frequency FM above 1 kHz are passed through the high-pass filter R14, R18, and C5 to the FM Driver circuit.

FM High Frequency Amplifier

High Frequency FM is amplified and inverted by Q7. Transistor Q8 acts as an emitter follower to drive the push-pull amplifiers Q9 and Q10. Resistor R46 is selected to match the YTO FM coil sensitivity. It may be necessary to change this resistor when a new A9 YTO Assembly is installed. The sensitivity of the coil is marked on the YTO label supplied with the new YTO. (See Paragraph 5-30, FREQUENCY MODULATION SENSITIVITY ADJUSTMENT.)

Table 8-5. Voltages for A4 Frequency Modulation Assembly

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	0	0	0
TP3	+ 0.6	+ 0.6	+ 0.6
TP4	GND	GND	GND
Q1-E	− 0.6	− 0.6	− 0.6
Q1-B	0	0	0
Q1-C	+14.9	+14.9	+14.9
Q2-S	0	0	0
Q2-G	0	+10.2	+10.2
Q2-D	0	0	0
Q3-E	− 0.6	− 0.6	− 0.6
Q3-B	0	0	0
Q3-C	+14.6	+14.6	+14.6
Q4-S	0	0	0
Q4-G	+ 9.3	0	+ 9.3
Q4-D	0	0	0
Q5-E	+15.2	+15.2	+15.2
Q5-B	+14.6	+14.6	+14.6
Q5-C	+ 0.6	+ 0.6	+ 0.6
Q6-E	0	+ 0.4	+ 0.6
Q6-B	+ 0.6	+ 0.6	+ 0.6
Q6-C	+16.2	+16.2	+16.2
Q7-E	+12.0	+12.0	+12.0
Q7-B	+11.4	+11.4	+11.4
Q7-C	+ 0.4	+ 0.4	+ 0.4
Q8-E	+ 0.6	+ 0.6	+ 0.6
Q8-B	+ 0.4	+ 0.4	+ 0.4
Q8-C	+ 9.7	+ 9.7	+ 9.7
Q9-E	+ 0.6	+ 0.6	+ 0.6
Q9-B	+ 1.2	+ 1.2	+ 1.2
Q9-C	+19.3	+19.3	+19.3
Q10-E	+ 0.5	+ 0.5	+ 0.5
Q10-B	+ 0.1	+ 0.1	+ 0.1
Q10-C	− 9.8	− 9.8	− 9.8
U1-2	0	0	0
U1-3	0	0	0
U1-6	0	0	0

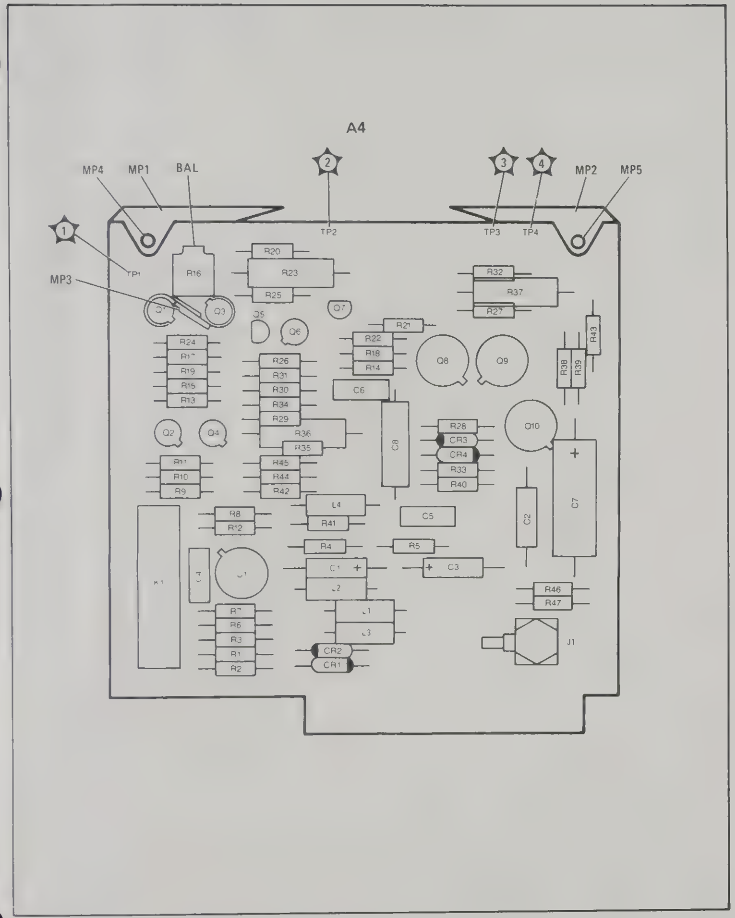
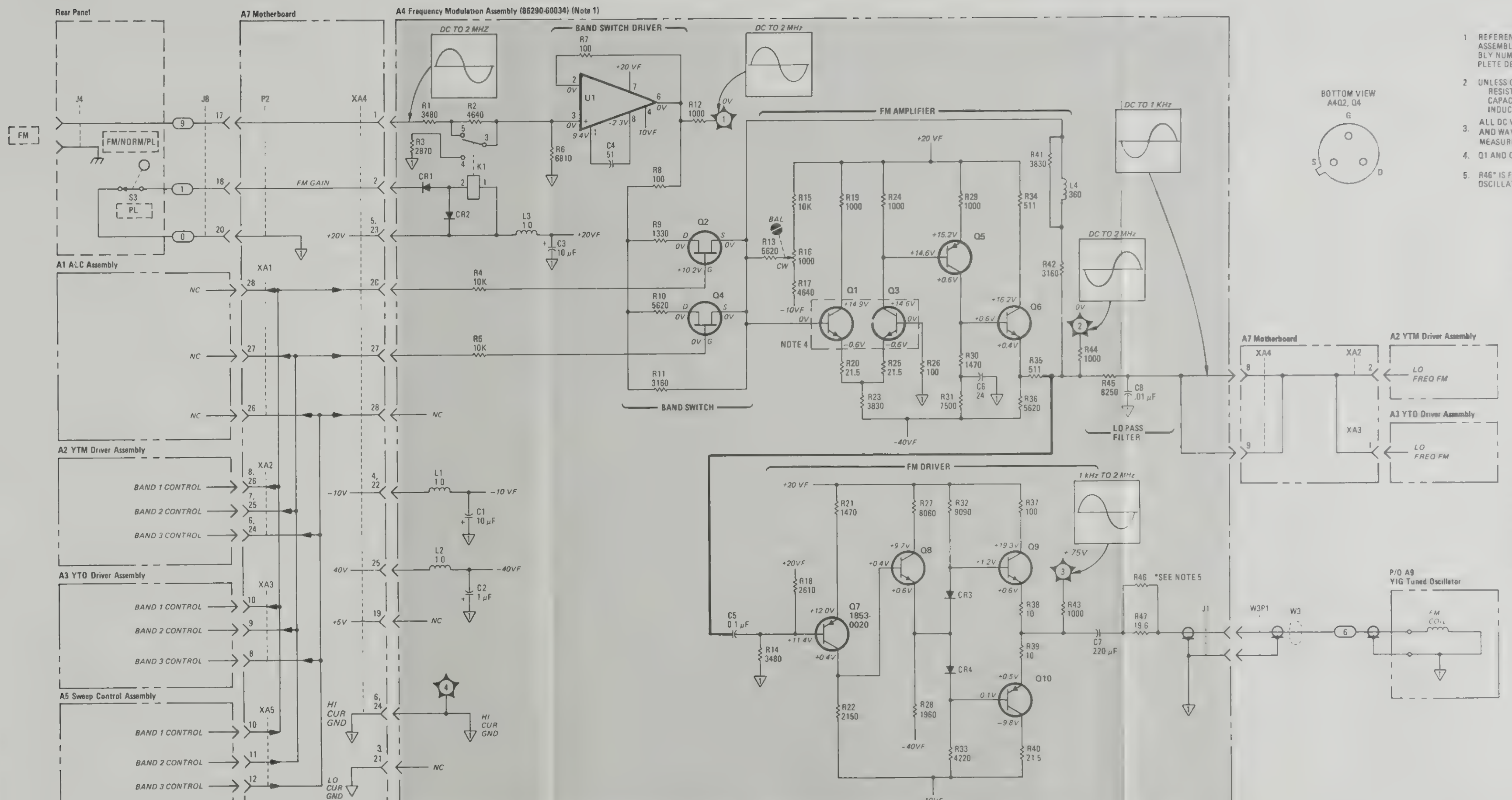


Figure 8-19. A4 FM Assembly, Component Locations



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS,
   INDUCTANCE IN MICROHENRIES
3. ALL DC VOLTAGES (CW, CENTER BAND) AND WAVEFORMS (FULL SWEEP, 10 ms) MEASURED IN BAND 4
4. Q1 AND Q3 HAVE A COMMON HEAT SINK
5. R46* IS FACTORY SELECTED TO MATCH YIG OSCILLATOR FM SENSITIVITY

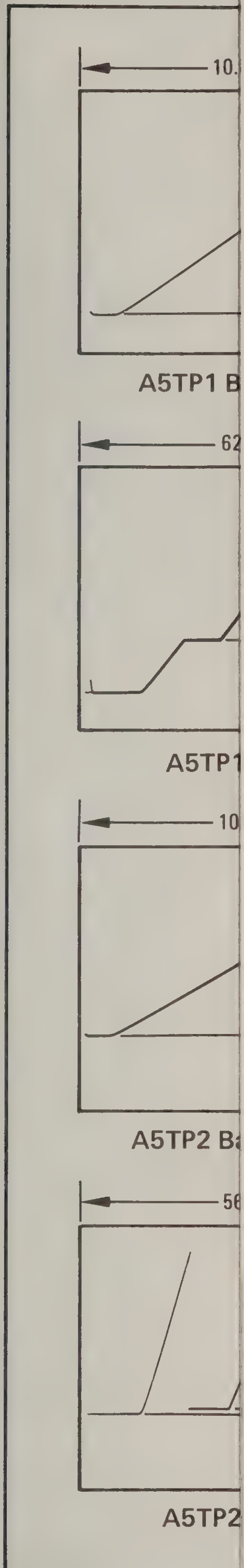
SENSITIVITY KHZ/MA	VALUE FOR R46 IN OHMS
150 – 175	13.3
175 – 200	21.5
200 - 225	31.6
225 – 250	51.1
250 – 275	100
275 – 300	316

REFERENCE DESIGNATIONS

NO PREFIX	A4
	C1 8
	CR1 - 4
J4 8	J1
	K1
S3	L1 4
W3	Q1 10
	R1 47
	U1

4
A4

Figure 8-20. A4 Assembly, Schematic


10.
A5TP1 B
62
A5TP1
10
A5TP2 Ba
56
A5TP2

SERVICE SHEET 5

A5 SWEEP CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A5 Sweep Control Assembly has two functions. The first is to supply band control signals to the FM, YTO Driver, and YTM Driver Assemblies. These control signals determine which band is ON at any given time. The second function is to condition the tuning voltage to become the Frequency Control Voltage for the YTO and YTM drivers. In each band, whether single or multiband, the drivers require a 0 to 10V frequency control voltage input to sweep each band of frequencies. This is true, for example, whether Band 1 is being swept with only Band 1 selected or whether Band 1 is being swept as the 2 6.2 GHz range of the 2 to 18.6 GHz Sequential Band 4. In single band, a single sweep is generated for each 0 to 10V sweep input from the mainframe. However, in Band 4 or Sequential Sweep, there are three 0 to 10V sweep outputs from the A5 Assembly for each 0 to 10V sweep input from the 8620C Sweep Oscillator.

Band Control Gates and Drives

Static band turn-on logic signals are applied to the U5 NOR gates from the mainframe. The other inputs to the NOR gates are the dynamic sequential Band signals from the A6 Assembly. With Band 4 selected, the sequential band logic circuit in the A6 Assembly generates three gates; one for each band. The U5A inputs are HI if Band 1 is selected or if Band 4 is selected and the sweep is sweeping the Band 1 frequency range. The +5-to-0V TTL level change applied to U4C is converted to a +10-to-0V level change and routed to the FM, YTM Driver, and YTO Driver Assemblies. This level change ensures turn off of the FET switching on the following assemblies. U5B output is LO with Band 2 selected or with Band 4 selected and the Band 2 range being swept. Similarly, NOR gate U5C and driver U4A are the Band 3 control circuits.

Single Band Operation

When single bands are selected, the tuning voltage input becomes the frequency control voltage. With Bands 1, 2, or 3 selected, Q12 is turned OFF and Q1 is ON. The tuning voltage is routed through Q1 and U2 to the A2 and A3 Assemblies.

The frequency control voltage amplifier U2 is a voltage follower and buffer amplifier stage. The single-band sweep driver Q12 is held OFF when not in Band 4 by the LO output of inverter U5D. At the same time, the HI output from inverter Q11 turns the sequential-band sweep driver Q10 ON. This pulls the gate of Q9 to −20V turning it OFF.

Sequential Sweep (Band 4) Operation

The generation of three 0 to 10V sweeps to obtain the 2.0 to 18.6 GHz sequential output is accomplished as follows. When Band 4 is selected, a HI is applied to buffer inverter U3C. The circuits following cause the single band sweep driver Q12 to turn ON which opens a single band switch Q1; sequential band sweep driver Q10 is OFF and Q9 is allowed to conduct. The sweep input from the 8620C mainframe changes from the single 0 to 10V ramp to a multi-level, interrupted ramp at TP1. The sweep is applied to the noninverting input of U1. U1 is embedded in a feedback circuit and the inverting input tracks closely the signal at A4TP1. Bands 1, 2, and 3 of the sequential sweep are generated as follows.

Sequential Sweep – Band 1

The Band 4 Turn-On line applies a HI sequential sweep enable to the sequential sweep select gates U3D, U3B, and U3A. During the 0 to +2.530V ramp (Band 1 range), the A6 Stop Sweep Assembly generates a HI for Sequential Band 1 (output of A6 Assembly 6 GHz switch point comparator). The output of NAND gate U3D is LO which ensures that FET driver Q5 is OFF. With the gate open and tied to the source through the 100K ohm resistor R61, Q2 will be ON. The other two FET drivers Q6 and Q7 receive a HI from NAND gates U3B and U3A respectively. This turns both drivers ON pulling the gates of Q3 and Q4 to −20V and turning them OFF. (The voltage dividers at the inputs of Q5, 5 and 6 maintain a bias so the transistors are just OFF.) The gain and level shifting resistors switched in with Q2 ON, provide a 0-to-10V ramp output from U1. These resistors are R8, R9, and HI adjust R62. With the input to U1 pin 3 set to +2.530V at TP1, R62 is adjusted for +10.000V at TP2. The frequency control voltage output to the YTO and YTM is the 0 to 10V Band 1 waveform at TP2.

Sequential Sweep – Bands 2 and 3

During Sequential Band 2, Q6 is OFF turning Q3 ON. This provides a new feedback circuit around U1. An offset is introduced through the voltage divider R15, R16, and adjusted by R4 (Band 2 B). The gain is set by R63, R14, and the equivalent impedance of the voltage divider. R3 (Band 2 A) is the gain control and adjusts the high-frequency end of the band. Due to the nature of the feedback scheme, there is some interaction between R4 (Band 2 B) and R3 (Band 2 A).

In Sequential Band 3, Q7 and Q4 provide the control. R6 (Band 3 B) is an offset control and adjusts the high-frequency end of the band. R7 (Band 3 A) adjusts the low end and thus the overlap between the high end of Band 2 and low end of Band 3. R6 (Band 3 B) and R7 (Band 3 A) also interact.

Resistor R63 prevents the saturation of U1 (should Q2, Q3 and Q4 be open simultaneously) by always providing some feedback; however, it is large enough not to affect the operation of the circuit. The OFFSET adjust R64 eliminates the offset voltage common to operational amplifiers. Any offset may drift with temperature changes and affect the tuning voltage or accuracy of the circuit.

Calibration/Normal Switch S1

CAL/NORM switch S1 substitutes the Band TURN ON signal from the mainframe for the sequential band signals from the A6 Assembly. The CAL position is used when aligning the sequential sweep offset and GAIN adjustments (U1, Q2-Q4). Without the CAL position, the A6 Assembly would switch bands each time the tuning voltage approached a band edge. By switching to CAL position and selecting Bands 1, 2, or 3 on the mainframe, the operator can set the frequency on the mainframe and adjust the corresponding LO and HI voltage at TP2.

Supply Voltages

The +11.75 volts and −20 volts are not available from the mainframe. These voltages are obtained using breakdown diodes VR1 and VR6. Breakdown diode VR1, connected to +20V, produces +11.75V and VR6, connected to −40V, produces the −20V. The +11.75V is used as a source voltage for the band control gates and drivers.

Remote Programming

The CW and Manual gate signal is input through voltage dividers R31 and R32 to enable Q8 which activates a filter consisting of R26, C1, and C2. This filter prevents the YTO and YTM from seeing an abrupt step change in the tuning voltage as would be encountered when remotely programming. Without the filtering, this step change may cause the YTO and YTM to poorly track and the power to drop and become unleveled.

To use this filter the following modification must be performed on the 8620C:

1. Disconnect 8620C power cord and remove top cover.

2. Remove 8620C A3 Assembly and add jumper as noted on Figures 8-16 and 8-17 of the 8620C manual (P/N 08620-90093). Also refer to 8620C ERRATA.

3. Replace A3 Assembly and instrument top cover.

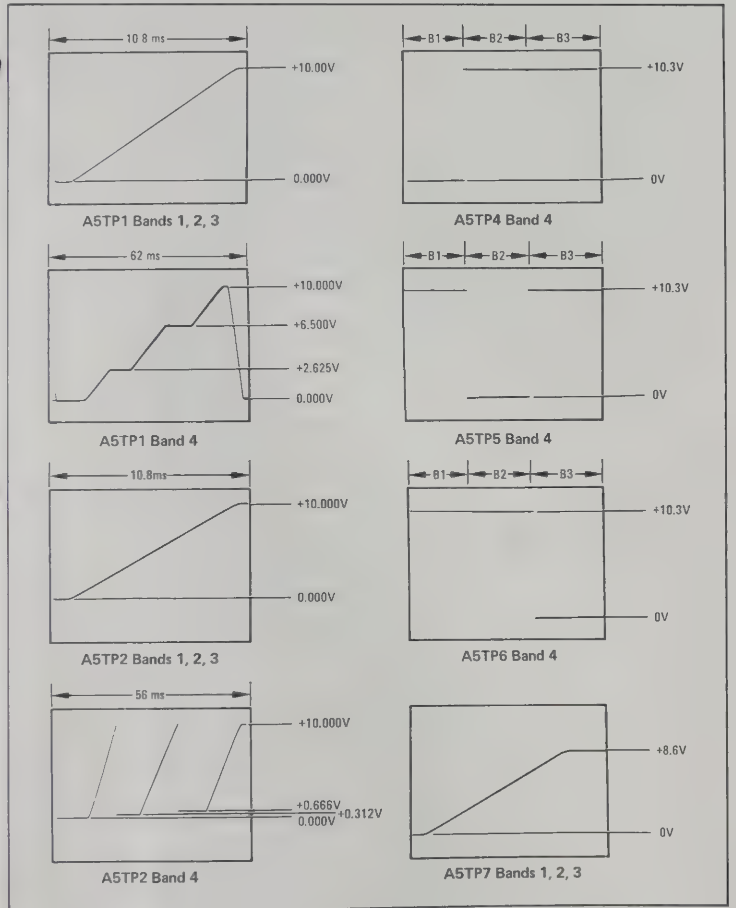


Figure 8-21. A5 Sweep Control Assembly, Waveforms (1 of 2)

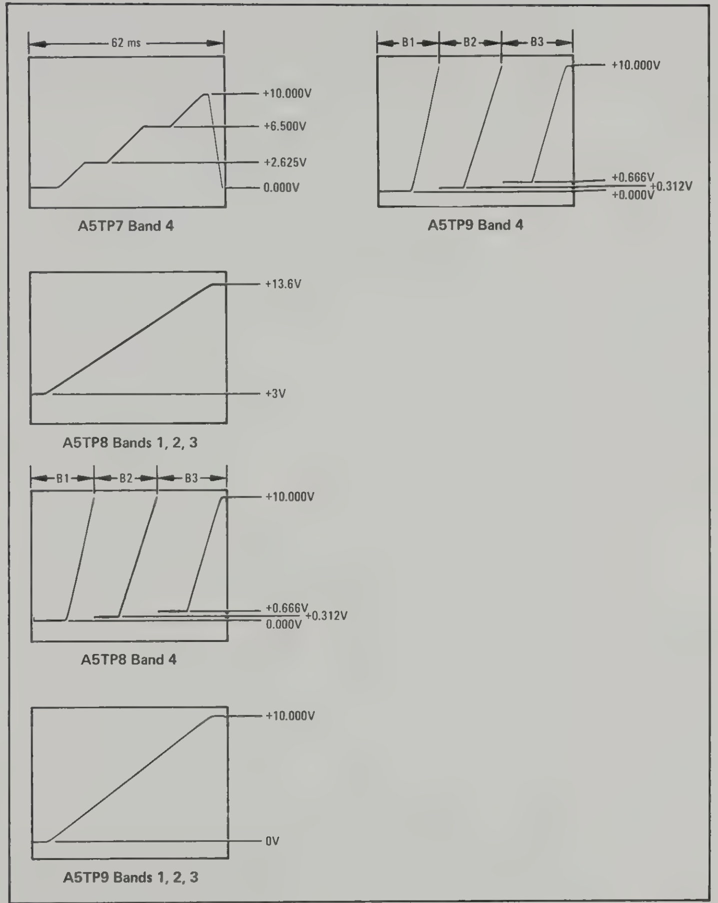
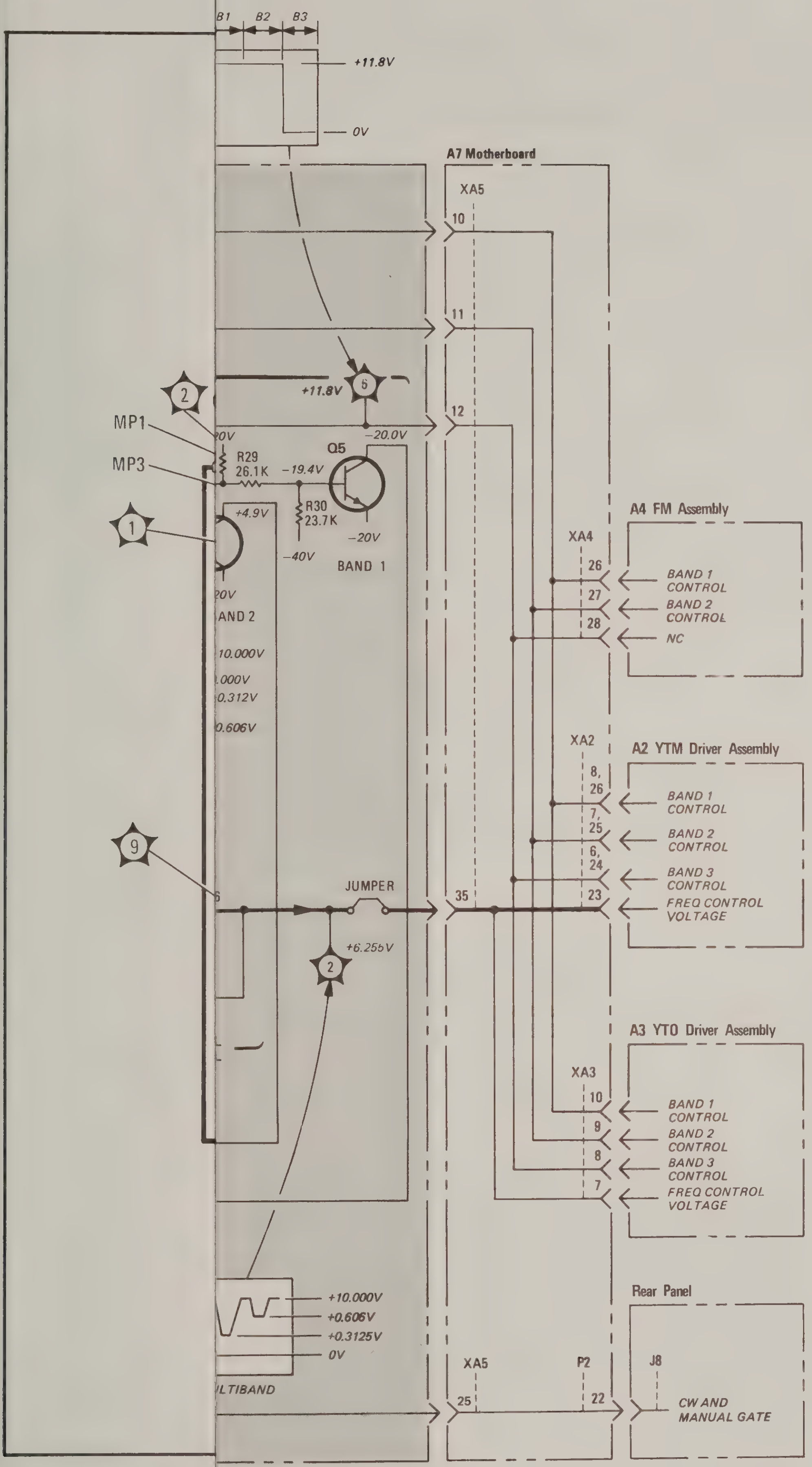


Figure 8-21. A5 Sweep Control Assembly, Waveforms (2 of 2)

Table 8-6. Voltages for A5 Sweep Control Assembly (3 of 3)

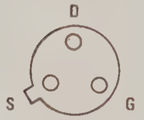
Test Point	Voltages Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U5A-1	+ 0.1	+10.3	+10.3
U5A-2	+ 0.2	+ 0.2	+ 0.2
U5A-3	+ 1.7	+ 0.3	+ 0.3
U5B-4	+10.3	+ 0.1	+10.3
U5B-5	+ 0.1	+ 0.1	+ 0.1
U5B-6	+ 0.3	+ 1.7	+ 0.3
U5C-8	+ 0.1	+ 0.1	+ 0.1
U5C-9	+ 0.3	+ 0.3	+ 1.7
U5C-10	+10.3	+10.3	+ 0.1
U5D-11	+ 4.9	+ 4.9	+ 4.9
U5D-12	+ 4.9	+ 4.9	+ 4.9
U5D-13	+ 0.1	+ 0.1	+ 0.1



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS
3. LOW CURRENT GROUND
4. HIGH CURRENT GROUND
5. FREQ REF GROUND
6. ALL DC VOLTAGES (CW,CENTER BAND) AND WAVEFORMS (FULL SWEEP, 10 ms) MEASURED IN BAND 4.
7. ALL WAVEFORMS MEASURED WITH Z-AXIS AND EXT HORIZ INPUT CABLES DISCONNECTED.

BOTTOM VIEW
A5Q1-Q3, Q7, Q8



REFERENCE DESIGNATIONS

NO PREFIX	A7	A5
P1 J7	P1, P2 XA1, XA2, XA3, XA4, XA5, XA6	CR1-CR4 Q1-Q11 R1-R47 S1 U1-U5 VR1-VR2

5
A5

Replac

Figure 8-23. Sweep Control Assembly, Schematic

Table 8-6. Voltages for A5 Sweep Control Assembly (1 of 3)

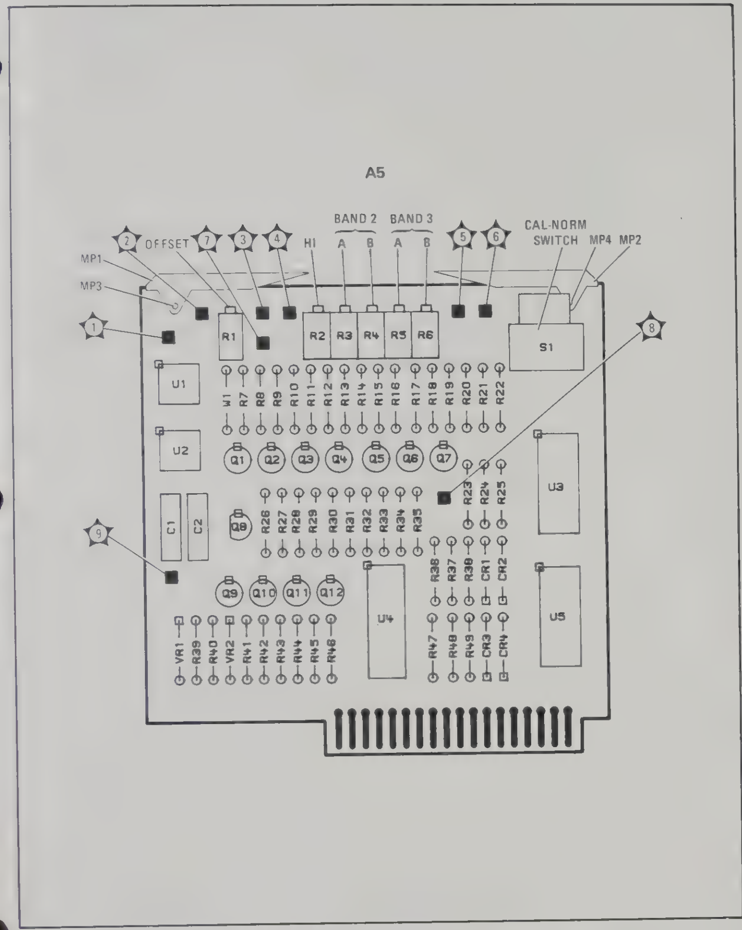
Test Point	Voltages Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	+ 5.000	+ 5.000	+ 5.000
TP2	+ 5.000	+ 5.000	+ 5.000
TP3	FREQ REF GND	FREQ REF GND	FREQ REF GND
TP4	0	+10.3	+10.3
TP5	+ 9.4	0	+ 9.4
TP6	+ 9.4	+ 9.4	0
TP7	+ 5.000	+ 5.000	+ 5.000
TP8	+ 5.75	+ 5.75	+ 5.75
TP9	+ 5.000	+ 5.000	+ 5.000
Q1-S	+ 1.2	+ 1.2	+ 1.2
Q1-G	−20.0	−20.0	−20.0
Q1-D	+ 5.000	+ 5.000	+ 5.000
Q2-S	+ 4.3	+ 4.3	+ 4.3
Q2-G	−20.0	−20.0	−20.0
Q2-D	+ 5.000	+ 5.000	+ 5.000
Q3-S	+ 7.8	+ 7.8	+ 7.8
Q3-G	−20.0	−20.0	−20.0
Q3-D	+ 5.000	+ 5.000	+ 5.000
Q4-E	−20.0	−20.0	−20.0
Q4-B	−19.4	−19.4	−19.4
Q4-C	−20.0	−20.0	−20.0
Q5-E	−20.0	−20.0	−20.0
Q5-B	−19.4	−19.4	−19.4
Q5-C	−20.0	−20.0	−20.0
Q6-E	−20.0	−20.0	−20.0
Q6-B	−19.4	−19.4	−19.4
Q6-C	−20.0	−20.0	−20.0
Q7-S	+ 5.000	+ 5.000	+ 5.000
Q7-G	+ 4.9	+ 4.9	+ 4.9
Q7-D	+ 5.000	+ 5.000	+ 5.000
Q8-S	+ 5.75	+ 5.75	+ 5.75
Q8-G	−20.0	−20.0	−20.0
Q8-D	+ 5.000	+ 5.000	+ 5.000

Table 8-6. Voltages for A5 Sweep Control Assembly (2 of 3)

Test Point	Voltages Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
Q9-E	−20.0	−20.0	−20.0
Q9-B	−19.4	−19.4	−19.4
Q9-C	−20.0	−20.0	−20.0
Q10-E	−20.0	−20.0	−20.0
Q10-B	−20.9	−20.9	−20.9
Q10-C	+ 5.0	+ 5.0	+ 5.0
Q11-E	+ 5.0	+ 5.0	+ 5.0
Q11-B	+ 4.2	+ 4.2	+ 4.2
Q11-C	+ 5.0	+ 5.0	+ 5.0
U1-2	+ 5.000	+ 5.000	+ 5.000
U1-3	+ 5.000	+ 5.000	+ 5.000
U1-6	+ 5.75	+ 5.75	+ 5.75
U2-2	+ 5.000	+ 5.000	+ 5.000
U2-3	+ 5.000	+ 5.000	+ 5.000
U2-6	+ 5.000	+ 5.000	+ 5.000
U3A-1	+ 0.4	+ 0.4	+ 0.4
U3A-2	0	0	0
U3A-3	+ 5.6	+ 5.6	+ 5.6
U3B-4	+ 0.4	+ 0.4	+ 0.4
U3B-5	0	0	0
U3B-6	+ 5.6	+ 5.6	+ 5.6
U3C-8	+ 4.9	+ 4.9	+ 4.9
U3C-9	+ 0.4	+ 0.4	+ 0.4
U3C-10	+ 0.4	+ 0.4	+ 0.4
U3D-11	+ 5.6	+ 5.6	+ 5.6
U3D-12	+ 0.4	+ 0.4	+ 0.4
U3D-13	+ 0.2	+ 0.2	+ 0.2
U4A-9	+10.3	+10.3	+ 0.1
U4A-10	+10.3	+10.3	0
U4B-11	+10.3	+ 0.1	+10.3
U4B-12	+10.3	0	+10.3
U4C-14	+ 0.1	+10.3	+10.3
U4C-15	0	+10.3	+10.3

Table 8-6. Voltages for A5 Sweep Control Assembly (3 of 3)

Test Point	Voltages Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U5A-1	+ 0.1	+10.3	+10.3
U5A-2	+ 0.2	+ 0.2	+ 0.2
U5A-3	+ 1.7	+ 0.3	+ 0.3
U5B-4	+10.3	+ 0.1	+10.3
U5B-5	+ 0.1	+ 0.1	+ 0.1
U5B-6	+ 0.3	+ 1.7	+ 0.3
U5C-8	+ 0.1	+ 0.1	+ 0.1
U5C-9	+ 0.3	+ 0.3	+ 1.7
U5C-10	+10.3	+10.3	+ 0.1
U5D-11	+ 4.9	+ 4.9	+ 4.9
U5D-12	+ 4.9	+ 4.9	+ 4.9
U5D-13	+ 0.1	+ 0.1	+ 0.1



Replacement Figure 8-22. A5 Sweep Control Assembly, Component Locations

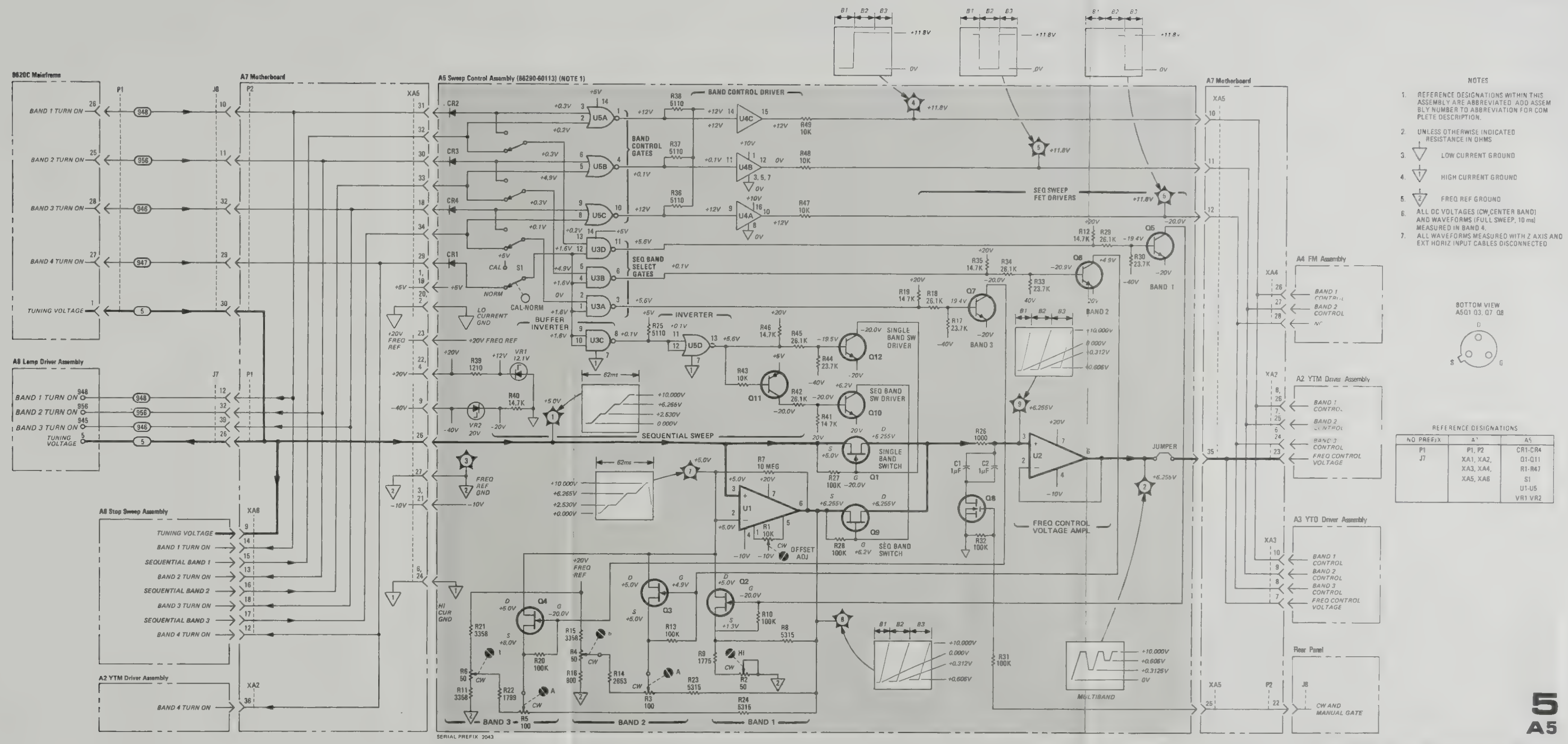


Figure 8-23. Sweep Control Assembly, Schematic

SERVICE SHEET 6

A6 STOP SWEEP ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The purpose of the A6 Stop Sweep Assembly is to generate control signals for Band 4 Sequential Sweep operation. The control signals include logic signals for control in the Plug-In and a stop pulse and sweep speed adjust control for the mainframe. The logic signals provide switching information to the A2 YTM and A3 YTO Drivers, and to the A5 Sweep Control Assembly. The stop pulse occurs at 6.2 GHz and at 12.4 GHz during the 2 to 18.6 GHz sweep. It is applied to the mainframe and causes the sweep oscillator to stop and wait for the YTO and YTM in the Plug-In to switch and stabilize in the new RF range. The sweep speed adjust control reduces the Band 4 sweep rate to approximately one-third that of the other bands. The A6 Assembly contains other circuits for control of special conditions in single band and sequential band operation. The 40-msec Timer, together with the comparator and pulse generator circuits, provides a correction pulse that prevents tracking errors when using slow repetition rates. Blanking pulses are generated by the A6 Assembly each time the BAND selector is pressed on the mainframe.

6.2 and 12.4 GHz Switch-Point Comparators and Stop Pulse Generators

When Band 4 is selected, the frequency range from 2 to 18.6 GHz is generated sequentially by a 0V to 10V ramp from the 8620C mainframe. Control signals are required to stop the sweep ramp at two switch-points: 6.2 GHz and 12.4 GHz. By stopping the sweep ramp at the switch points, power and frequency gaps are avoided as the frequency is swept sequentially across three separate ranges.

Also in sequential operation, fast sweep tracking between the YTO and YTM is necessary. To achieve this, the maximum rate of frequency change must be no greater than in single-band operation. Since the 2 to 18.6 GHz range is about three times wider than the other ranges, the maximum sweep rate is reduced by a factor of three when operating sequentially. These two operations are accomplished as follows.

The two switch-point comparators consist of U8 and U7, the LO and HI reference potentiometers R2 and R6, and associated components. When Band 4 is selected, the Band 4 Turn On Line is HI and K1 energizes closing contacts 5 and 6. At the start of a sweep, the inputs at pin 3 of U7 and U8 are LO (0V) and both outputs are HI (+5V). U6A/U6D produces a LO at U6B pin 4. The output of U6B pin 6 is LO. When the sweep voltage at U8 pin 3 is equal to the reference voltage on pin 2 (+2.530), the sweep is at the 6.2 GHz switch-point and the U8 comparator changes state. The exclusive OR gates at U6C and U6B also change states and a low-high transition is applied to pins 2 and 9 of U3A and U3B respectively (U3 is a monostable multivibrator). A low-high transition on the B input, when the CLR is HI and the A input is LO, generates a pulse at 1Q (U3A pin 13). The pulse is 6 msec in duration, as established by C7 and R23, and is applied to the mainframe as a stop-sweep pulse. The leading edge of this pulse marks the point in time that the YTM and YTO begin switching from range 1 to range 2. (The CLR input is HI except during special conditions explained in the 40-msec Timer circuit.) After a 6 msec delay, the sweep input from the mainframe continues to increase. At the 12.4 GHz switch-point, it equals the 6.265V reference voltage on U7 pin 2, and U7 changes state. Again the exclusive OR gates U6C and U6B change states and a high-low transition is applied to U3 pins 2 and 9. With a HI on the B input (U3B pin 10) and the CLR HI, a pulse is generated at 2Q (U3B pin 5) with a high-low transition input. The duration of the pulse is 8 msec set by C8 and R24. The leading edge of this pulse marks the point in time that the YTM and YTO begin switching from 2 to range 3. On retrace, U7 and U8 change to HI states as the sweep crosses through 6.265V first and then 2.530V. Although pulses are generated during retrace, they are blanked out in the mainframe and not present on the tuning voltage.

Resistor R11 provides feedback to modify the reference voltage at U8 pin 2. It causes the reference voltage to decrease by approximately 320 mV. With the reference voltage at U8 pin 2 less than the sweep voltage at U8 pin 3, the output of U8 will be held LO. If the reference voltage remained unchanged, any voltage drop on the sweep input during the dwell time could cause U8 to oscillate. Similar feedback is provided with R12 but the offset voltage is approximately 55 mV. The following test may be used to check R11 and the offset voltage. Select CW Mode and manually set the tuning voltage to zero. Check for +2.530V at TP5. Rotate the CW control so the tuning voltage is above 2.530 V. The voltage at TP5 should drop to about 2.500V. TP3 is used to check R12; as the tuning voltage is adjusted below, then about +6.265V.

The positive 6 msec and 8 msec pulses are summed in OR gate U4D. The output of U4D is applied to the A8 lamp Driver Assembly to disable the UNLEVELED lamp, and is inverted by Q5 and applied to the mainframe as stop sweep pulses. The stop sweep pulses are inverted in the mainframe and used to gate open the path between the current source and the ramp integrator.

Blanking Pulse Generators

The pulse outputs from the blanking pulse generators U2A and U2B provide three functions: 1) The blanking pulses to the A1 ALC assembly produce maximum drive current into the modulator, the PIN diodes are full ON, and hence no RF Output. The blanking pulses are 4 msec and 6 msec in duration. The pulses are shorter than the stop pulses to ensure the RF is on before the ramp begins sweeping again. 2) The YIG-Tuned Multiplier Assembly requires a leading edge to indicate exactly when band switching occurs. This Kick Trigger generates an error signal in the YTM driver to compensate for YTM delay characteristics. 3) The positive pulses are applied to OR gate U4C and routed to the rear panel SEQ SYNC connector J3. These pulses can be used as a timing signal for external equipment.

The blanking pulse generators U2A and U2B operate exactly as the stop pulse generators U3A and U3B; therefore, a low-high transition produces a 4 msec pulse from U2A at the 6.2 GHz switch-point, and a high-low transition produces a 6 msec pulse from U2B at the 12.4 GHz switch-point. The pulses are summed in OR gate U4B and provide the three functions described above.

Sync Output

The ouput from U4C is routed to J3 on the 86290B rear panel and to the mainframe rear panel PROGRAMMING connector. The outputs from U4C are blanking signals used by the HP 8410B Network analyzer. During a Low-high transition the RF is being turned OFF and the 8410B will not try to lock up. However, on the high-low transition, RF comes ON and the analyzer initiates a search that continues until lock is achieved. One input to U4C is the sequential band blanking pulse occurring at each switch-point. The other input is the retrace blanking signal.

Sequential Band Logic

The Sequential Band Logic circuit initiates logic levels that indicate which band is to be enabled. For example, when the tuning voltage is in range 1 (between 0V and +2.530V), the logic level for Sequential Band 1 is HI. The logic levels for Sequential Bands 2 and 3 are LO. At the 6.2 GHz switch-point, range 2 is initiated: the logic level for Sequential Band 2 is HI and Bands 1 and 3 are LO. At the 12.4 GHz switch-point, range 3 is initiated with Band 3 HI and the other two bands LO. These logic levels are routed to A5 Sweep Control Assembly to generate the Band 1, 2, and 3 frequency control signals. These controls are then applied to the YTO and YTM drivers. The sequential band logic levels are generated as follows.

The output voltage level of switch-point comparator U8 becomes Sequential Band 1 since the output is HI when the tuning voltage is in range 1 (0V to +2.530V). The output voltage of U7 is LO when the tuning voltage is in range 3 (+6.265V to 10.0V). The output of U7 is inverted by Q7 and the HI output is Sequential Band 3. To obtain the correct logic level for Band 2, a combination of the Band 1 and Band 3 logic is used as follows. The logic levels of Band 1 and Band 3 are applied to OR gate CR6 and CR7. When either input is HI, the input to inverter Q8 is HI. (The combination of CR6/7 and Q8 form a dual-input NOR gate.) When the tuning voltage is 0V the HI from Q8 is applied to CR6 so Sequential Band 2 is LO. Sequential Band 2 is generated as the tuning voltage crosses the 6.2 GHz switch point, at which time Band 3 is LO and Band 1 changes to LO. With both CR6 and CR7 cutoff, Q8 is OFF and the output is HI. At the 12.6 GHz switchpoint, Band 3 applies a HI to CR7 turning Q8 ON.

Comparator Summing

During the selection of a new band at the mainframe, the YTO and YTM could cross points where they would track momentarily and cause a burst of power. Therefore, any time the band lever is depressed on the mainframe, the RF is turned OFF with a blanking pulse generated either by U2A or U2B. Operation is as follows. The Band 1 and Band 3 Turn ON signals are applied to an exclusive OR gate U6A. Anytime a band is changed, there will be level change on one of the two inputs. Since U6A is an exclusive OR, any change at an input will cause the output to change. Assuming normal operation in Band 2, selecting Band 3 would change the Band 3 Turn On input to HI. The logic levels would change so the output of U6B would go to LO. A high-low transition generates a 6 msec blanking pulse from U2B. If Band 1 had been selected initially, there would have been a LO output from U6B. A change at the band selector would have caused a Low-high transition to generate a 4 msec blanking pulse by U2A. The blanking pulse widths differ in accordance with the different durations used for the stop pulses.

Kick Trigger

The Stop Pulse and Blanking Pulse Generator circuits U3 and U2 have a common connection to the output of U6B pin 6. Anytime a 6 msec stop sweep pulse is generated by U3A, a 4 msec Kick Trigger is generated by U2A. Similarly, pulses occur simultaneously from U3B and U2B. These Kick Triggers are routed to the A2 YTM assembly to be used in the Sequential Compensation Driver circuit. Two different pulse widths are used because the delay compensation required by the YTM differs at the two switchpoints. For example, to regain tracking once it is lost as 12.4 GHz requires more time than at 6.2 GHz. A 4 msec pulse is generated for Band 2 and a 6 msec pulse for Band 3.

40 msec Timer

The YTO and YTM will track normally at fast or standard sweep repetition rates. If, however, the time between sweep cycles exceeds 40 msec, the 40 msec timer and associated logic produce periodic trigger pulses which maintain the correct YTO-YTM tracking relationship. The logic must first indicate that the time between sweeps exceeds 40 msec, then it must enable the appropriate pulse generator.

Selecting either Band 4 or the 0.1 to .01 Second gate on the mainframe enables the 40 msec timer circuit by applying a high input to the base of Q3, which turns on and grounds the emitter of Q2. With its emitter grounded, Q2 is enabled to operate as an amplifier for any input it receives from Q6.

The 40 msec timer circuit monitors the blanking input from the mainframe and starts timing on each high-to-low transition of the negative-going blanking pulse, that is, at the start of each sweep cycle. After being inverted by Q6, the leading edge of the blanking pulse is differentiated by C9/R33. This, in turn, produces a narrow, negative-going pulse at the collector of Q2, which is applied to U1A pin 1. At repetition rates slower than approximately 40 msec, pulses from Q2 trigger U1A into its quasi-stable state (Q output low) where it remains for about 40 msec before returning to its stable state. The width of the output pulse in this case is determined by U1A's external timer circuit, C14 and R38. When the input pulse repetition rate is faster than approximately 40 msec between pulses, the multivibrator will not have timed out before the next pulse input arrives to retrigger its timer circuit. It will, therefore, stay in the quasi-stable state. This quasi-stable state will continue as long as the time between the leading edges of the input pulses is less than the time limit of approximately 49 msec set with U1A's external RC timer circuit.

Each time U1A is triggered out of its stable state into its quasi-stable state, its Q output (pin 4) makes a high-to-low transition. This transition acts as a trigger for U1B, also a retriggerable monostable multivibrator. The Q output at U1B pin 12 is normally high; when it makes a transition from low to high, that is, on the trailing edge of its output pulse, it applies a "Clear" input to retriggerable monostables U2A, U2B, U3A, and U3B.

When a negative-going transition occurs at U1B pin 9, a negative-going pulse is generated at U1B pin 12, the Q output. The duration of this pulse, as established by U1B's external timing circuit, R36 and C11, is approximately 1 msec. The positive-going transition of this pulse, when it is applied to the "Clear" input of an enabled monostable, triggers the monostable into its quasi-stable state. The enable input is taken from the output of exclusive OR gate U6B and turns on only two of the monostables at a time. If U6B's output is high, U2A and U3A are enabled and U2B and U3B are disabled. During a low output from U6B, this condition is reversed.

A positive-going transition from U1B pin 12 causes either U2A or U2B to generate a positive-going "kick trigger" pulse output, and either U3A or U3B to generate a positive-going "stop sweep" output pulse. When the output of U6B is low, U2B and U3B each supply an output when they are triggered by a positive-going transition on their "Clear" inputs. The "stop sweep" pulse from U3B is set for a width of about 8 msec by U3B's external timer, C8-R24. It is fed through OR gate U4D to the Lamp Driver Assembly and, after being inverted by Q5, to the mainframe. The "kick trigger" from U2B is set for a width of about 6 msec by the U2B timer circuit, C10-R35.

Positive-going transitions from U1B pin 12 that occur during the period the monostable's output is high (quasi-stable state), will restart the monostable's external timer and cause the output to stay high through another timer cycle.

With a high output from U6B, U2A and U3A generate the "kick trigger" and "sweep stop" outputs. The timer circuits on U2A and U3A set the unextended width of the "kick trigger" pulse to approximately 4 msec, and the unextended width of the "sweep stop" pulse to about 6 msec.

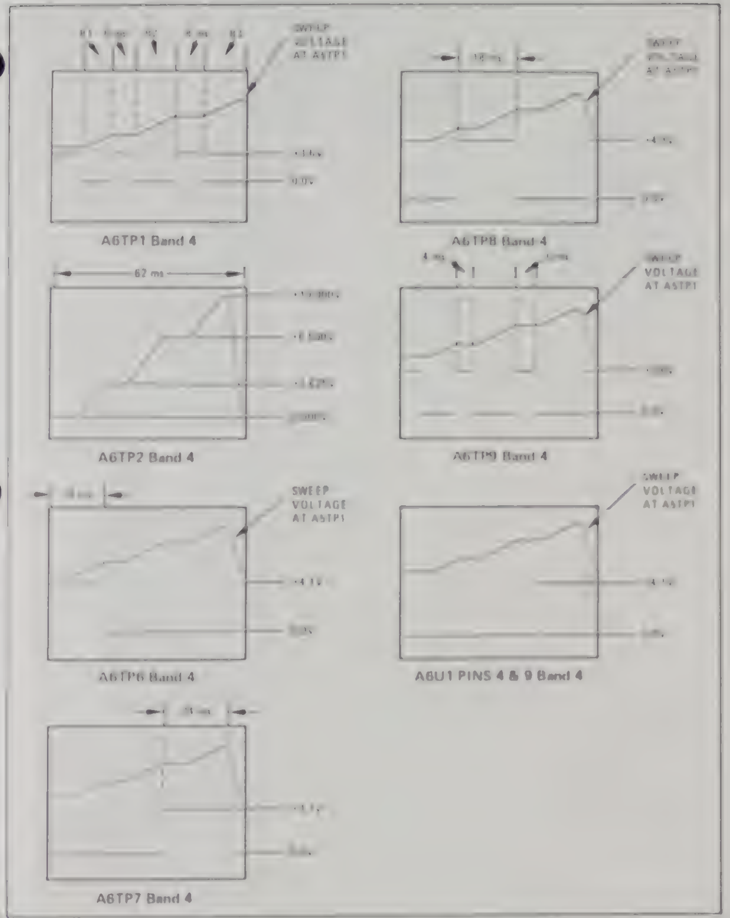


Figure 8-24. A6 Stop Sweep Assembly, Waveforms

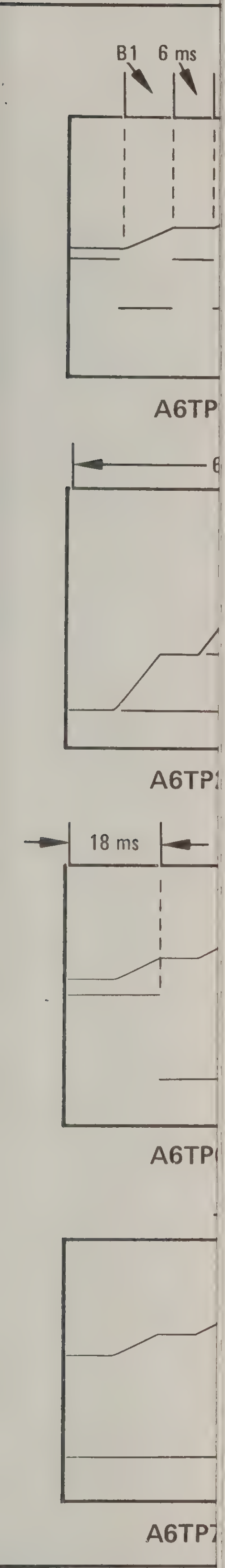

B1
6 ms
18 ms

Table 8-7. Voltages for A6 Stop Sweep Assembly (1 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	0	0	0
TP2	+19.7	+19.7	+19.7
TP3	GND REF	GND REF	GND REF
TP4	+ 6.265	+ 6.265	+ 6.265
TP5	+ 2.530	+ 2.530	+ 2.530
TP6	+ 0.2	+ 0.2	+ 0.2
TP7	0	0	0
TP8	0	0	0
TP9	+ 0.1	+ 0.1	+ 0.1
TP10	0	0	0
Q1-E	0	0	0
Q1-B	0	0	0
Q1-C	+ 1.6	+ 1.6	+ 1.6
Q2-E	0	0	0
Q2-B	+ 0.6	+ 0.6	+ 0.6
Q2-C	0	0	0
Q3-E	0	0	0
Q3-B	+ 0.1	+ 0.1	+ 0.1
Q3-C	+ 4.0	+ 4.0	+ 4.0
Q4-E	0	0	0
Q4-B	0	0	0
Q4-C	+ 1.6	+ 1.6	+ 1.6
Q5-E	0	0	0
Q5-B	+ 0.2	+ 0.2	+ 0.2
Q5-C	0	0	0
Q6-E	0	0	0
Q6-B	+ 0.6	+ 0.6	+ 0.6
Q6-C	0	0	0
Q7-E	0	0	0
Q7-B	− 0.3	− 0.3	− 0.3
Q7-C	+19.0	+19.0	+19.0
Q8-E	0	0	0
Q8-B	+ 0.7	+ 0.7	+ 0.7
Q8-C	0	0	0
Q9-E	0	0	0
Q9-B	+ 0.7	+ 0.7	+ 0.7
Q9-C	0	0	0

Table 8-7. Voltages for A6 Stop Sweep Assembly (2 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2	Band 3
U1A-3	+ 1.6	+ 1.6	+ 1.6
U1A-4	+ 4.4	+ 4.4	+ 4.4
U1B-9	+ 4.4	+ 4.4	+ 4.4
U1B-12	+ 4.2	+ 4.2	+ 4.2
U2-2	+ 6.265	+ 6.265	+ 6.265
U2-3	+19.7	+19.7	+19.7
U2-7	+ 0.2	+ 0.2	+ 0.2
U3-2	+ 2.530	+ 2.530	+ 2.530
U3-3	+19.7	+19.7	+19.7
U3-7	+ 0.2	+ 0.2	+ 0.2
U4A-2	+ 0.1	+ 3.7	+ 0.1
U4A-3	+ 4.2	+ 4.2	+ 4.2
U4A-13	+ 0.1	+ 0.1	+ 0.1
U4B-5	+ 0.1	+ 0.1	+ 0.1
U4B-9	+ 0.1	+ 3.7	+ 0.1
U4B-11	+ 4.2	+ 4.2	+ 4.2
U5A-1	0	0	0
U5A-2	0	0	0
U5B-5	+15.8	+15.8	+15.8
U5B-6	+ 0.6	+ 0.6	+ 0.6
U5B-7	+18.8	+18.8	+18.8
U6A-1	+ 0.1	+ 0.1	+ 0.1
U6A-2	+ 0.1	+ 0.1	+ 0.1
U6A-3	0	0	0
U6B-4	0	0	0
U6B-5	+ 0.1	+ 0.1	+ 0.1
U6B-6	0	0	0
U6C-8	0	0	0
U6C-9	+ 0.5	+ 0.5	+ 0.5
U6D-11	+ 0.1	+ 0.1	+ 0.1
U6D-12	+ 0.1	+ 0.1	+ 0.1
U6D-13	+ 0.1	+ 0.1	+ 0.1

Table 8-7. Voltages for A6 Stop Sweep Assembly (3 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U6B-4	+ 0.1	+ 0.1	+ 0.1
U6B-5	+ 0.1	+ 0.1	+ 0.1
U6B-6	+ 0.1	+ 3.7	+ 0.1
U6C-9	+ 0.2	+ 0.2	+ 0.2
U6C-10	+ 0.2	+ 0.2	+ 0.2
U6C-8	+ 0.1	+ 0.1	+ 0.1
U6D-11	+ 0.1	+ 3.8	+ 0.1
U6D-12	+ 3.8	+ 0.1	+ 3.8
U6D-13	+ 1.6	+ 1.6	+ 1.6
U7-2	+ 6.265	+ 6.265	+ 6.265
U7-3	+19.7	+19.7	+19.7
U7-7	+ 0.2	+ 0.2	+ 0.2
U8-2	+ 2.530	+ 2.530	+ 2.530
U8-2	+19.7	+19.7	+19.7
U8-7	+ 0.2	+ 0.2	+ 0.2

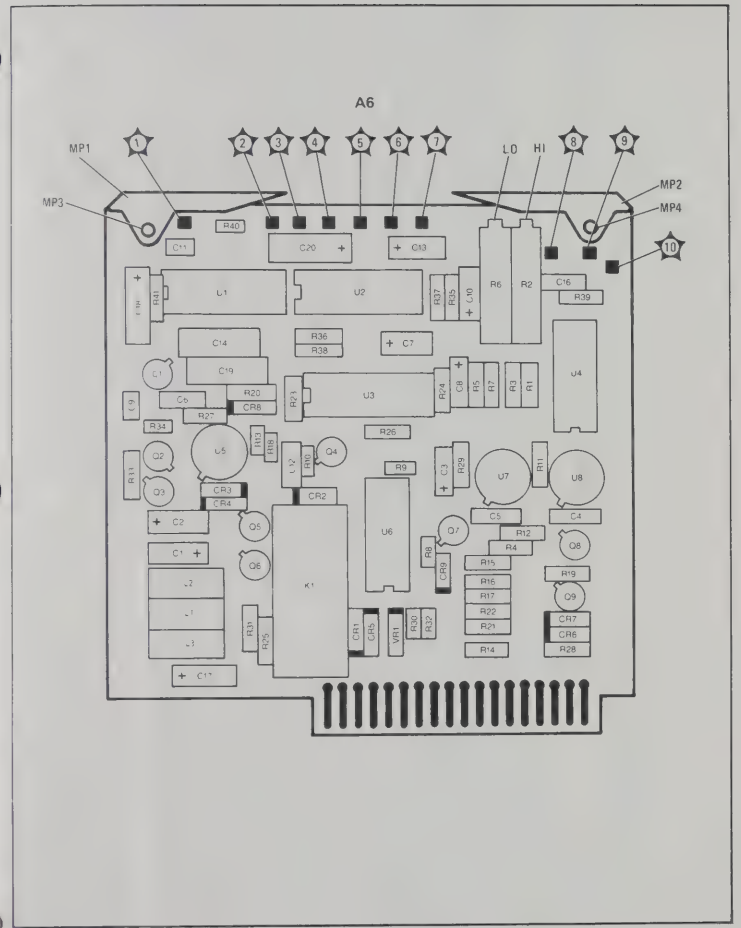


Figure 8-25. A6 Stop Sweep Assembly, Component Locations

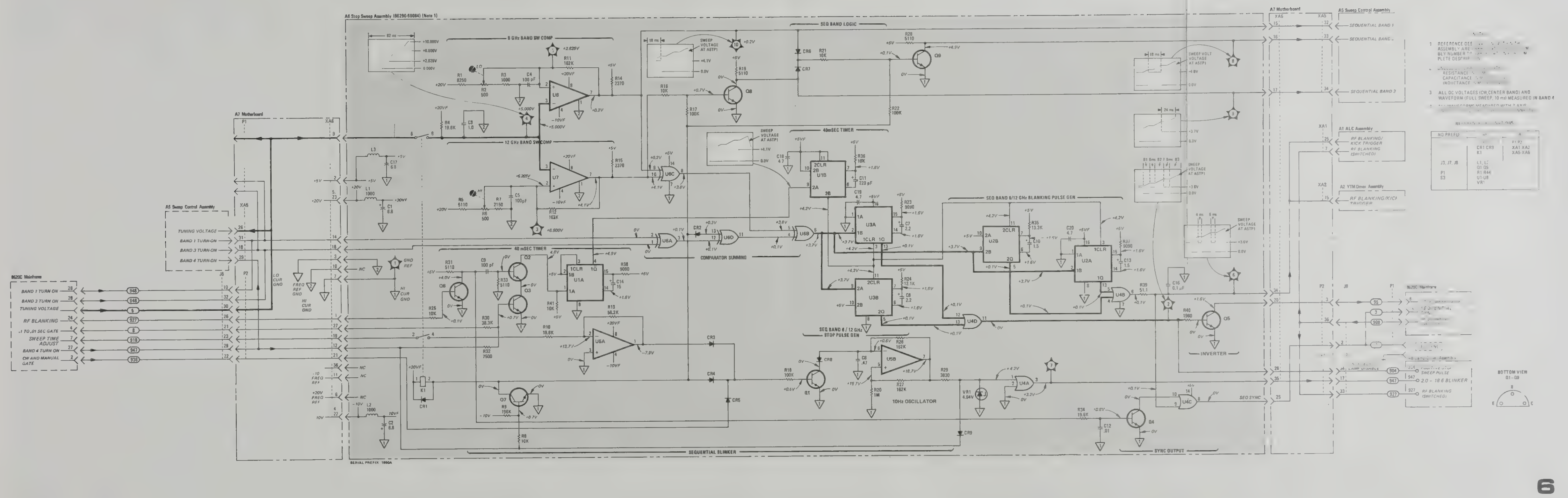
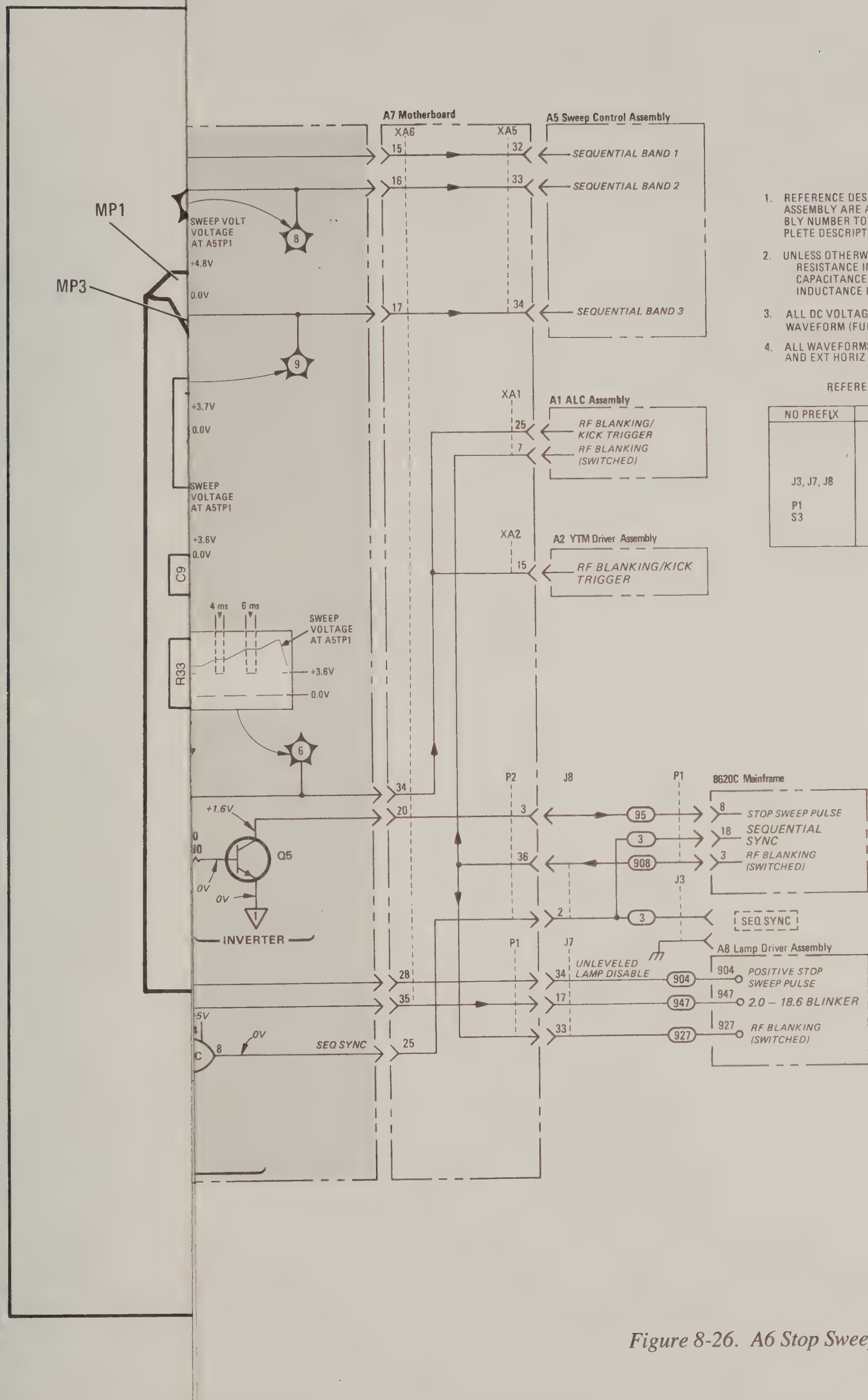


Figure 8-26. A6 Stop Sweep Assembly, Schematic

Table 8-7. Voltages for A6 Stop Sweep Assembly (3 of 3)

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
U6B-4	+ 0.1	+ 0.1	+ 0.1
U6B-5	+ 0.1	+ 0.1	+ 0.1
U6B-6	+ 0.1	+ 3.7	+ 0.1
U6C-9	+ 0.2	+ 0.2	+ 0.2
U6C-10	+ 0.2	+ 0.2	+ 0.2
U6C-8	+ 0.1	+ 0.1	+ 0.1
U6D-11	+ 0.1	+ 3.8	+ 0.1
U6D-12	+ 3.8	+ 0.1	+ 3.8
U6D-13	+ 1.6	+ 1.6	+ 1.6
U7-2	+ 6.265	+ 6.265	+ 6.265
U7-3	+19.7	+19.7	+19.7
U7-7	+ 0.2	+ 0.2	+ 0.2
U8-2	+ 2.530	+ 2.530	+ 2.530
U8-2	+19.7	+19.7	+19.7
U8-7	+ 0.2	+ 0.2	+ 0.2

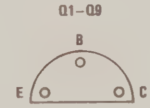


NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN MICROFARADS;
   INDUCTANCE IN MICROHENRIES.
3. ALL DC VOLTAGES (CW,CENTER BAND) AND WAVEFORM (FULL SWEEP, 10 ms) MEASURED IN BAND 4.
4. ALL WAVEFORMS MEASURED WITH Z-AXIS AND EXT HORIZ INPUT CABLES DISCONNECTED.

REFERENCE DESIGNATIONS

NO PREFIX	A6	A7
	C1-C20 CR1-CR9 K1	P1,P2 XA1-XA3, XA5-XA6
J3, J7, J8 P1 S3	L1, L2 Q1-Q9 R1-R44 U1-U8 VR1	



6
A6

Figure 8-26. A6 Stop Sweep Assembly, Schematic

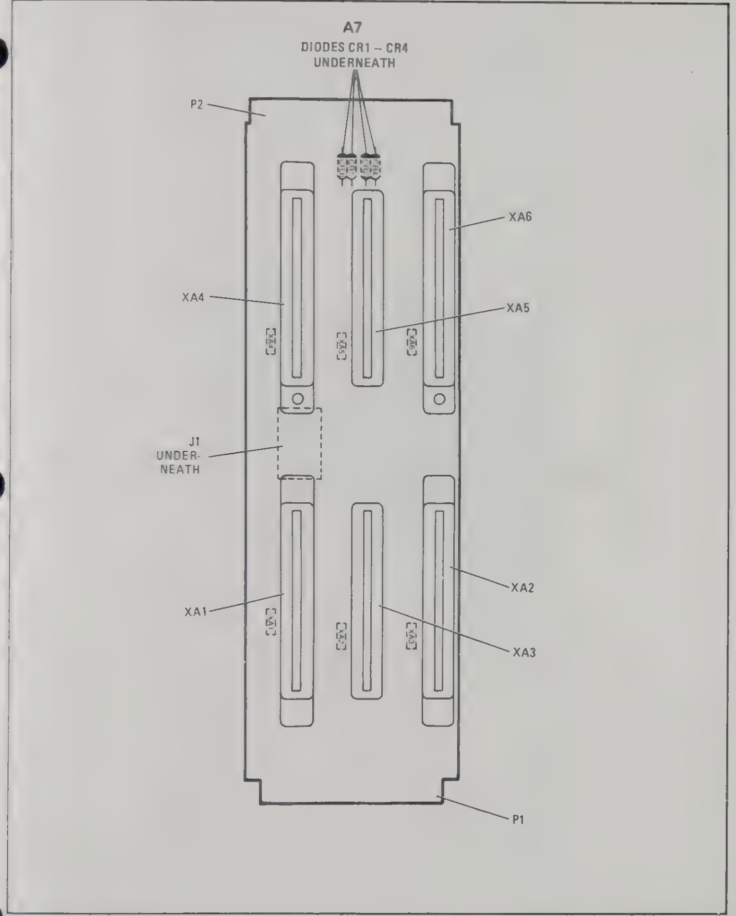


Figure 8-27. A7 Motherboard, Component Locations

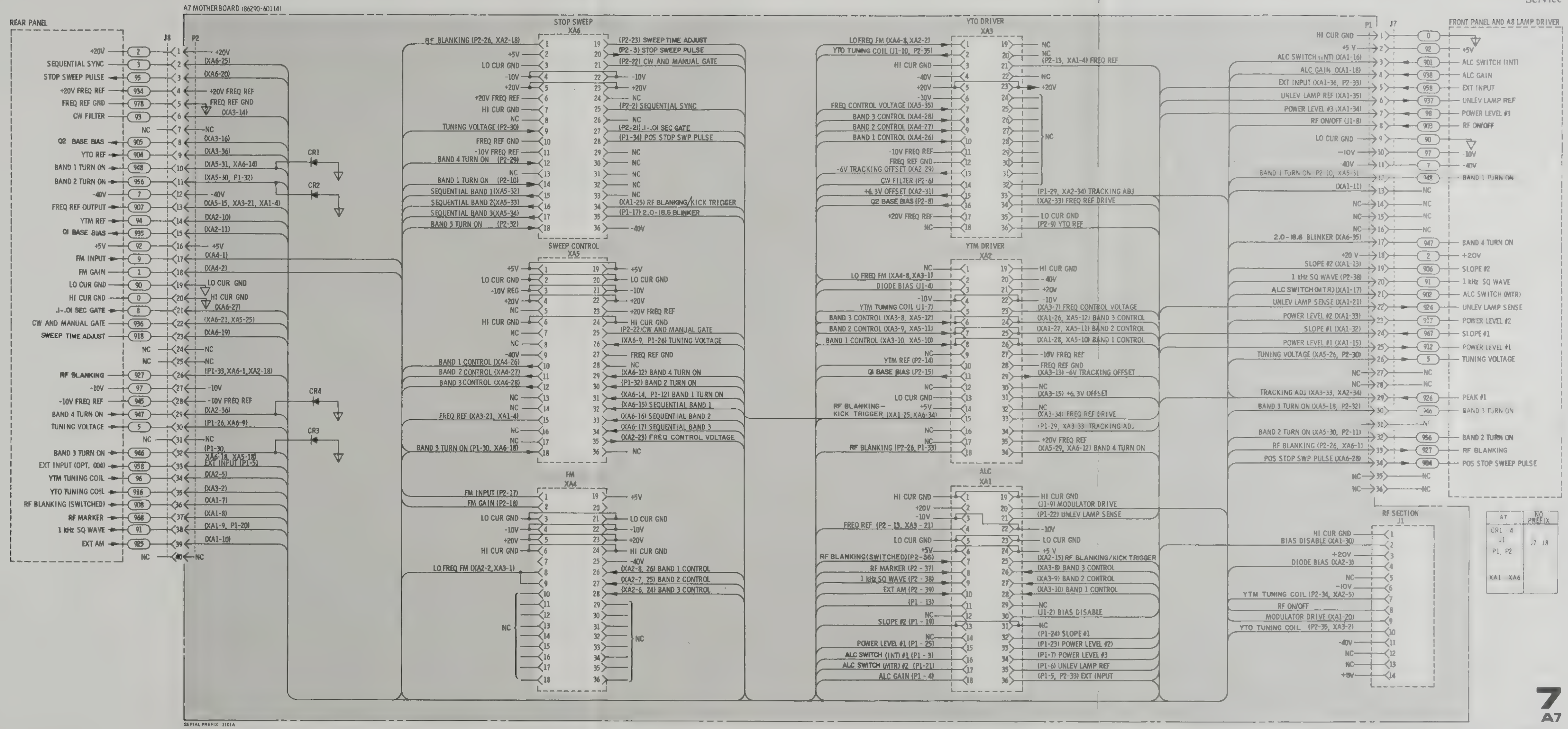
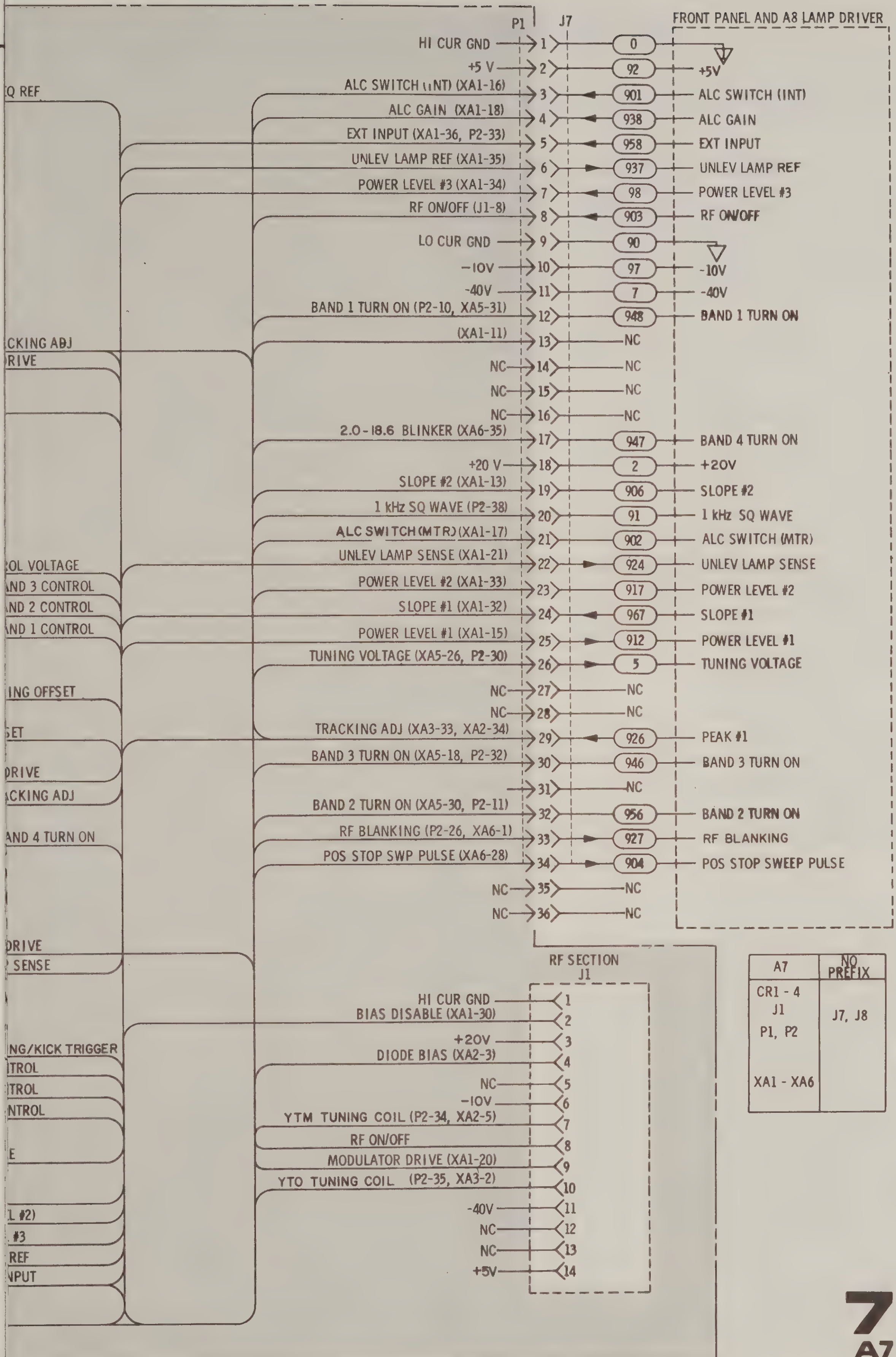


Figure 8-28. A7 Motherboard, Interconnect Diagram



A7	NO PREFIX
CR1 - 4 J1 P1, P2 XA1 - XA6	J7, J8

7
A7

Figure 8-28. A7 Motherboard, Interconnect Diagram

SERVICE SHEET 8

A8 LAMP DRIVER ASSEMBLY, CIRCUIT DESCRIPTION

Display Lamp Drivers

The display on the front panel indicates the frequency band selected. When Band 1, 2, or 3 is selected with the mainframe BAND switch, a HI is applied to the lamp drivers Q1, Q2, or Q3 respectively. These transistors are normally OFF but conduct with +4V applied.

Unleveled Lamp Control and Driver

The Unleveled Lamp control circuit monitors the modulation level from the A1 ALC Assembly. When the modulator drive is OFF (no attenuation), the front-panel UNLEVELED lamp DS1, is turned ON. When the ALC loop is closed (power is leveled), DS1 is OFF.

The Unleveled Lamp reference voltage at U1 pin 2 (−2.6V) comes from the ALC Assembly. With no RF present or the ALC open, the Unleveled Lamp sense voltage (modulator drive) at U1 pin 3 is more negative than the reference. This condition saturates U1 in a positive direction. A HI turns Q5 and Q6 ON and Q6 drives the UNLEVELED lamp DS1 ON. When the loop is closed U1 pin 3 is more positive than pin 2 and the output of U1 is ground. A LO turns Q5 OFF, removes drive from Q6 and DS1 is OFF.

As the frequency range selected is swept, the operating point of the modulator is continually monitored. If some portion of the sweep is unleveled, a HI turns Q5 ON. Capacitor C2 charges positive and maintains drive to Q6 for an extended time. This allows the ON interval to be "lengthened" for operator viewing of the unleveled indication.

Unleveled Lamp Control Disable

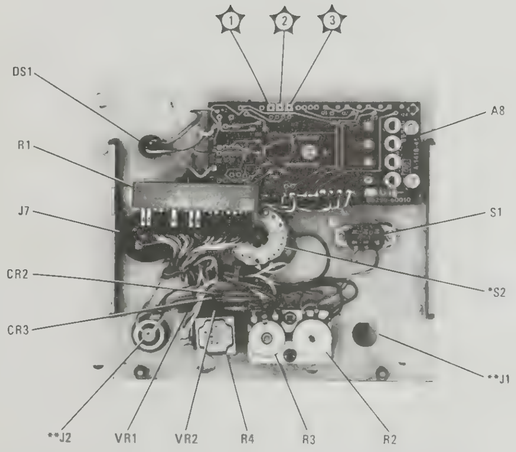
In swept operation, there are times within each sweep cycle when it is undesirable for the UNLEVELED lamp to indicate an unleveled condition, even though RF power during these intervals is less than the level set by the front-panel POWER LEVEL control; for example, during retrace, during automatic band switching in Band 4, or during "OFF" period when using internal 1 kHz square wave modulation. Therefore, the UNLEVELED lamp is disabled and remains "OFF" during these time intervals. Diodes CR1, CR2, and CR3 monitor for the three conditions mentioned above, and a HI input to any one of these diodes will turn both Q7 and Q8 ON. With Q8 ON, the base of Q5 is grounded. Any voltage on the Unleveled lamp sense line that would normally turn ON DS1 is disabled and the UNLEVELED lamp remains OFF.

Slope Driver – Flatness Compensation

The slope driver, U2, provides the offset voltage for the front-panel SLOPE control R3. This is accomplished by attenuating and offsetting the tuning voltage at divider R1 and R3. When the tuning voltage is swept between its end limits of 0 and +10 volts, the output of U2 is swept between −5 and 0 volts. A portion of this ramp is summed with the power reference control to compensate for high-frequency power losses in external cabling.

Table 8-8. Voltages for A8 Lamp Driver Assembly

Test Point	Voltages		
	Band 1 (Vdc)	Band 2 (Vdc)	Band 3 (Vdc)
TP1	+ 0.1	+ 0.1	+ 0.1
TP2	0	0	0
TP3	− 2.5	− 2.5	− 2.5
Q1-E	−10.0	−10.0	−10.0
Q1-B	− 9.3	−10.3	−10.3
Q1-C	− 9.9	− 2.7	− 2.7
Q2-E	−10.0	−10.0	−10.0
Q2-B	−10.3	− 9.3	−10.3
Q2-C	− 2.7	− 9.9	− 2.7
Q3-E	−10.0	−10.0	−10.0
Q3-B	−10.3	−10.3	− 9.3
Q3-C	− 2.7	− 2.7	− 9.9
Q4-E	−10.0	−10.0	−10.0
Q4-B	−10.3	−10.3	−10.3
Q4-C	− 2.7	− 2.7	− 2.7
Q5-E	+ 4.3	+ 4.3	+ 4.3
Q5-B	+ 4.9	+ 4.9	+ 4.9
Q5-C	+ 4.8	+ 4.8	+ 4.8
Q6-E	0	0	0
Q6-B	+ 0.7	+ 0.7	+ 0.7
Q6-C	+ 0.1	+ 0.1	+ 0.1
Q7-E	0	0	0
Q7-B	0	0	0
Q7-C	+ 5.0	+ 5.0	+ 5.0
Q8-E	0	0	0
Q8-B	0	0	0
Q8-C	+ 4.9	+ 4.9	+ 4.9
U1-2	− 2.5	− 2.5	− 2.5
U1-3	+ 0.5	+ 0.5	+ 0.2
U1-7	+ 0.1	+ 0.1	+ 0.1
U2-2	− 2.5	− 2.5	− 2.5
U2-3	− 2.5	− 2.5	− 2.5
U2-6	− 2.5	− 2.5	− 2.5



*Contact detail of the ALC switch S2 is given in Figure 8-1 near the beginning of this section

**Connectors J1 and J2 are mounted on rear panel as J9 and J10 for Option 004.

Figure 8-29. Front Panel, Component Locations

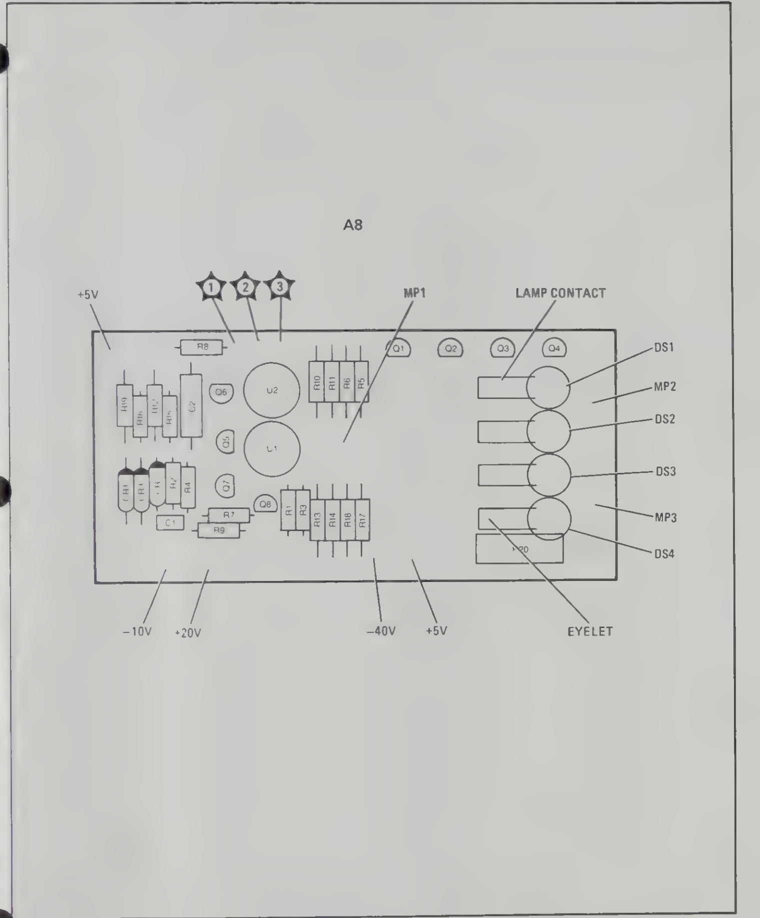


Figure 8-30. A8 Lamp Driver Assembly, Component Locations

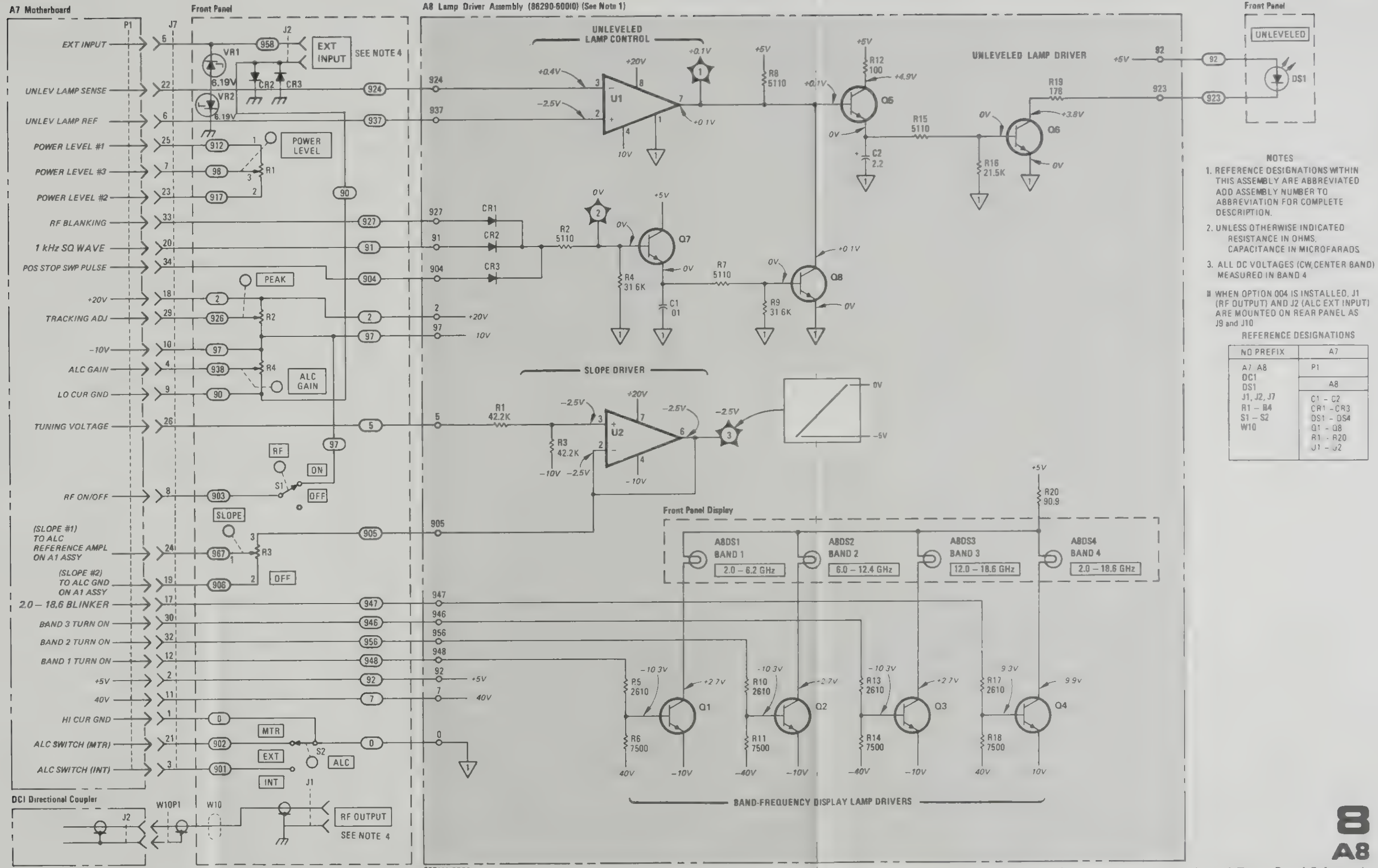
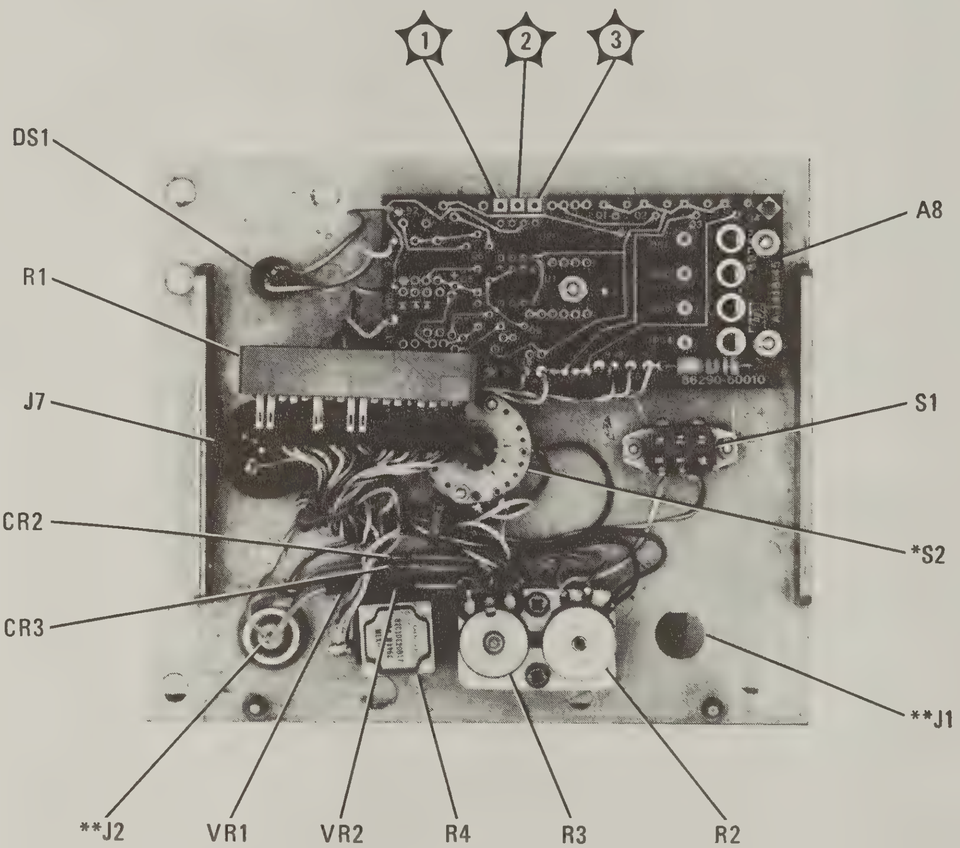


Figure 8-31. A8 Lamp Driver Assembly and Front Panel Schematic

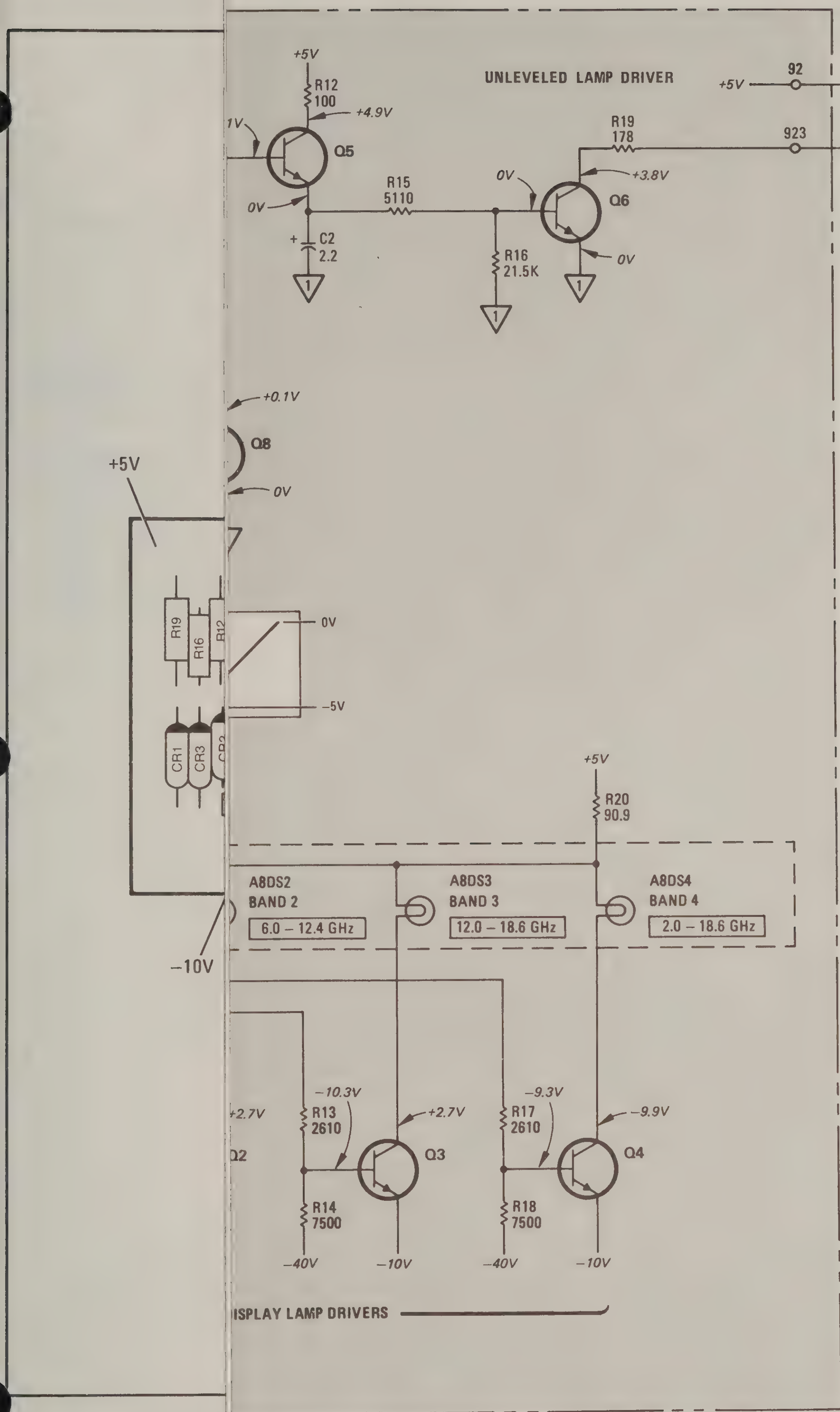
8
A8

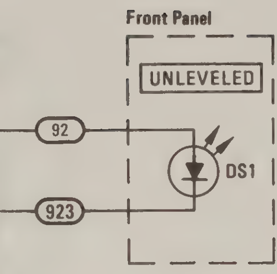


*Contact detail of the ALC switch S2 is given in Figure 8-1 near the beginning of this section.

**Connectors J1 and J2 are mounted on rear panel as J9 and J10 for Option 004.

Figure 8-29. Front Panel, Component Locations





NOTES:

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS
3. ALL DC VOLTAGES (CW, CENTER BAND) MEASURED IN BAND 4.
4. WHEN OPTION 004 IS INSTALLED, J1 (RF OUTPUT) AND J2 (ALC EXT INPUT) ARE MOUNTED ON REAR PANEL AS J9 and J10.

REFERENCE DESIGNATIONS

NO PREFIX	A7
A7, A8, DC1, DS1, J1, J2, J7, R1 – R4, S1 – S2, W10	P1
	A8
	C1 – C2, CR1 – CR3, DS1 – DS4, Q1 – Q8, R1 – R20, U1 – U2

8

A8

Figure 8-31. A8 Lamp Driver Assembly and Front Panel Schematic

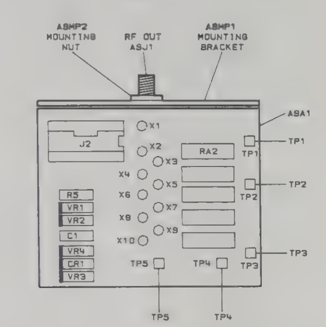
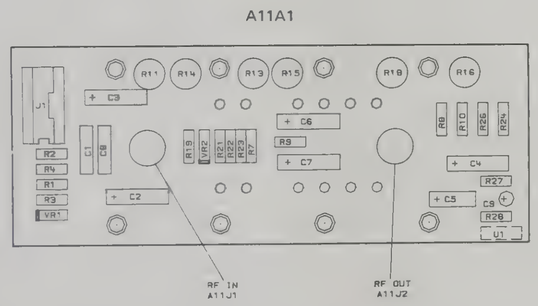


Figure 8-32. A9 YTO Component Locations



*NOTE: THIS ILLUSTRATION IS INCLUDED HERE ONLY AS AN AID IN TROUBLESHOOTING. THE A11A1 ASSEMBLY IS PART OF THE A11 POWER AMPLIFIER ASSEMBLY AND IS NOT SEPARATELY REPLACEABLE. THE +5V REGULATOR A11U1 MAY BE REPLACED IN THE EVENT OF FAILURE. NO FURTHER REPAIR OF THE A11A1 ASSEMBLY SHOULD BE ATTEMPTED. THE HP PART NUMBER FOR THE +5V REGULATOR A11U1 IS 1826-0294

Figure 8-33. A11A1 Power Amplifier Board Assembly Component Locations

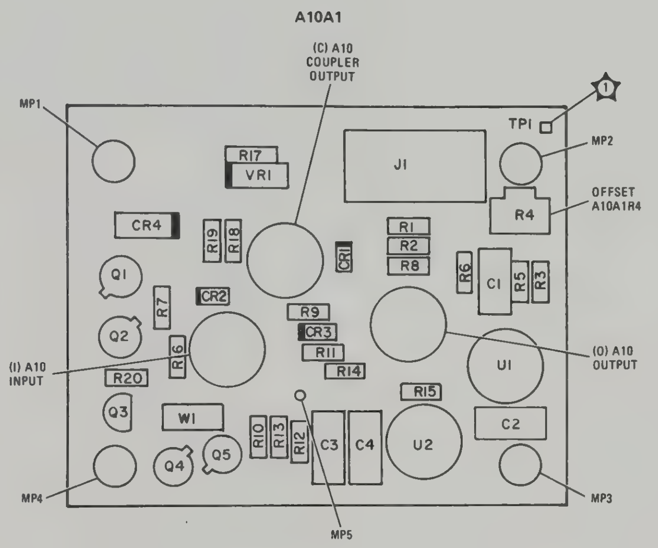
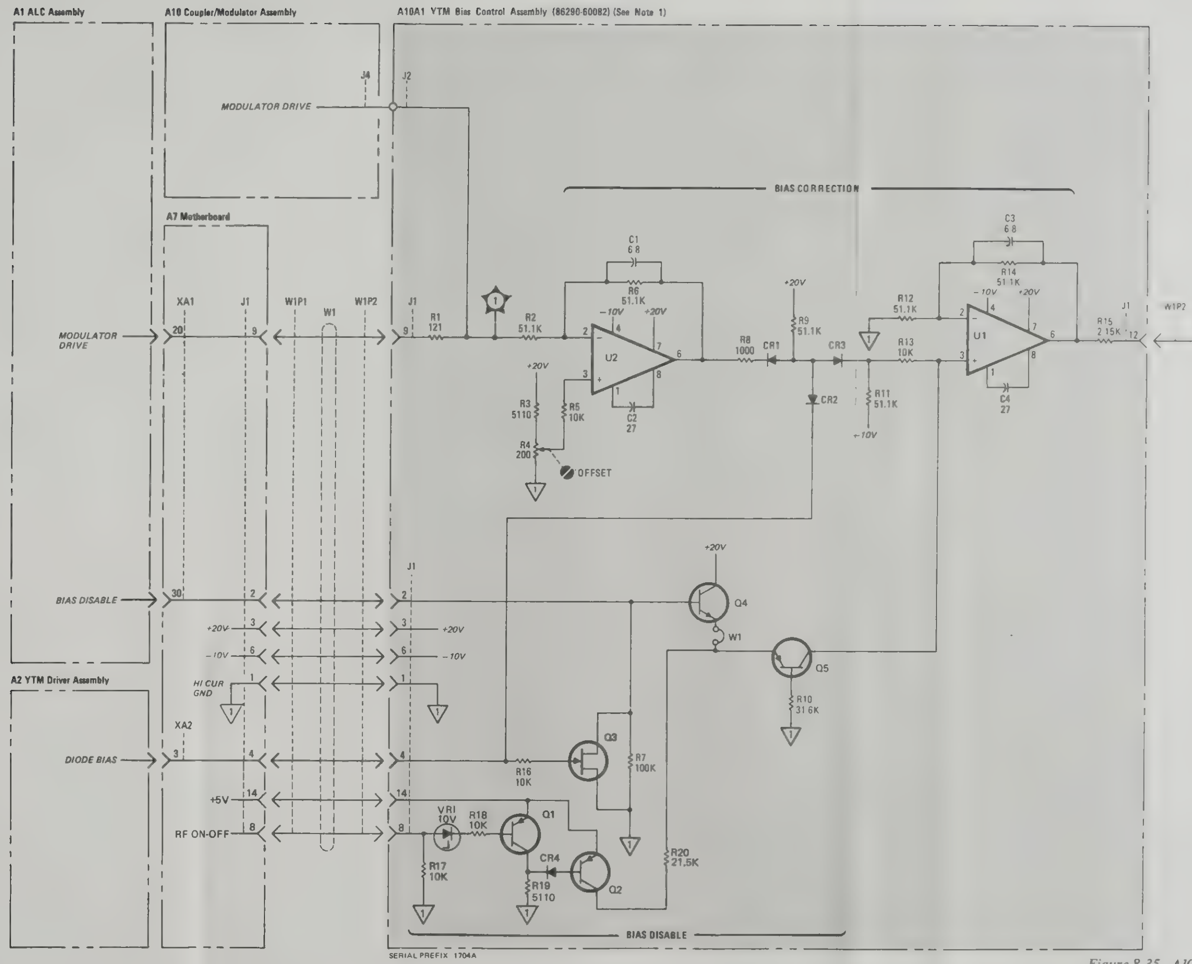


Figure 8-34. A10A1 YTM Bias Control Assembly, Component Locations



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS, CAPITANCE IN PICOFARADS

REFERENCE DESIGNATORS

NO PREFIX	A10A1
A1, A2, A7 A10, A12A1 W1 W1P1, W1P2 W1P5	C1 C4 CR1-CR3 Q1 Q3 R1-R16 U1 U2

9
A10A1

Figure 8-35. A10A1 YTM Bias Control Assembly, Schematic

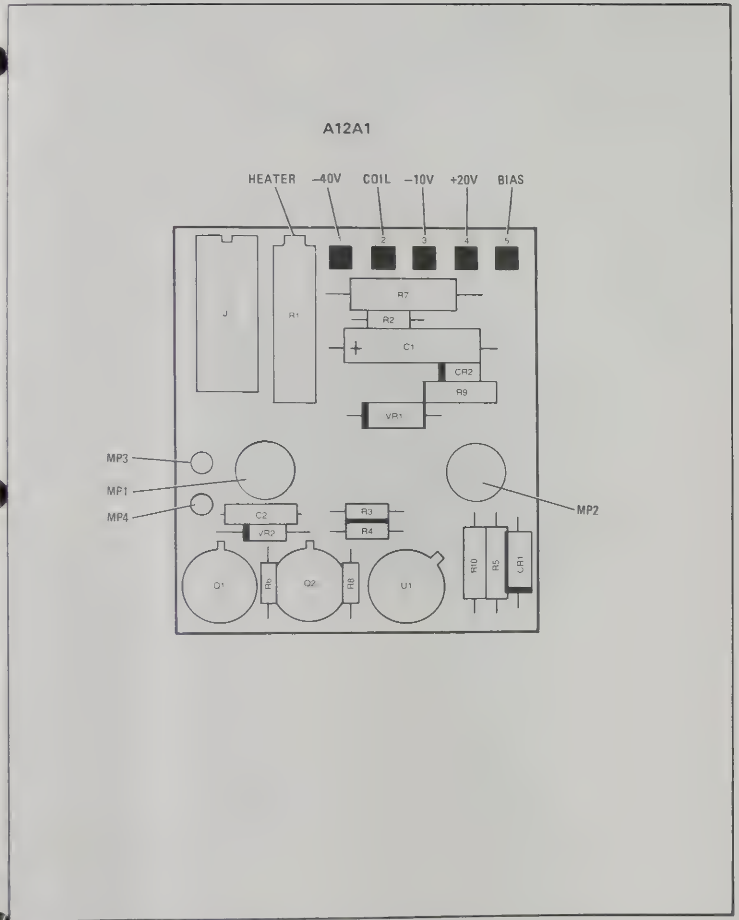
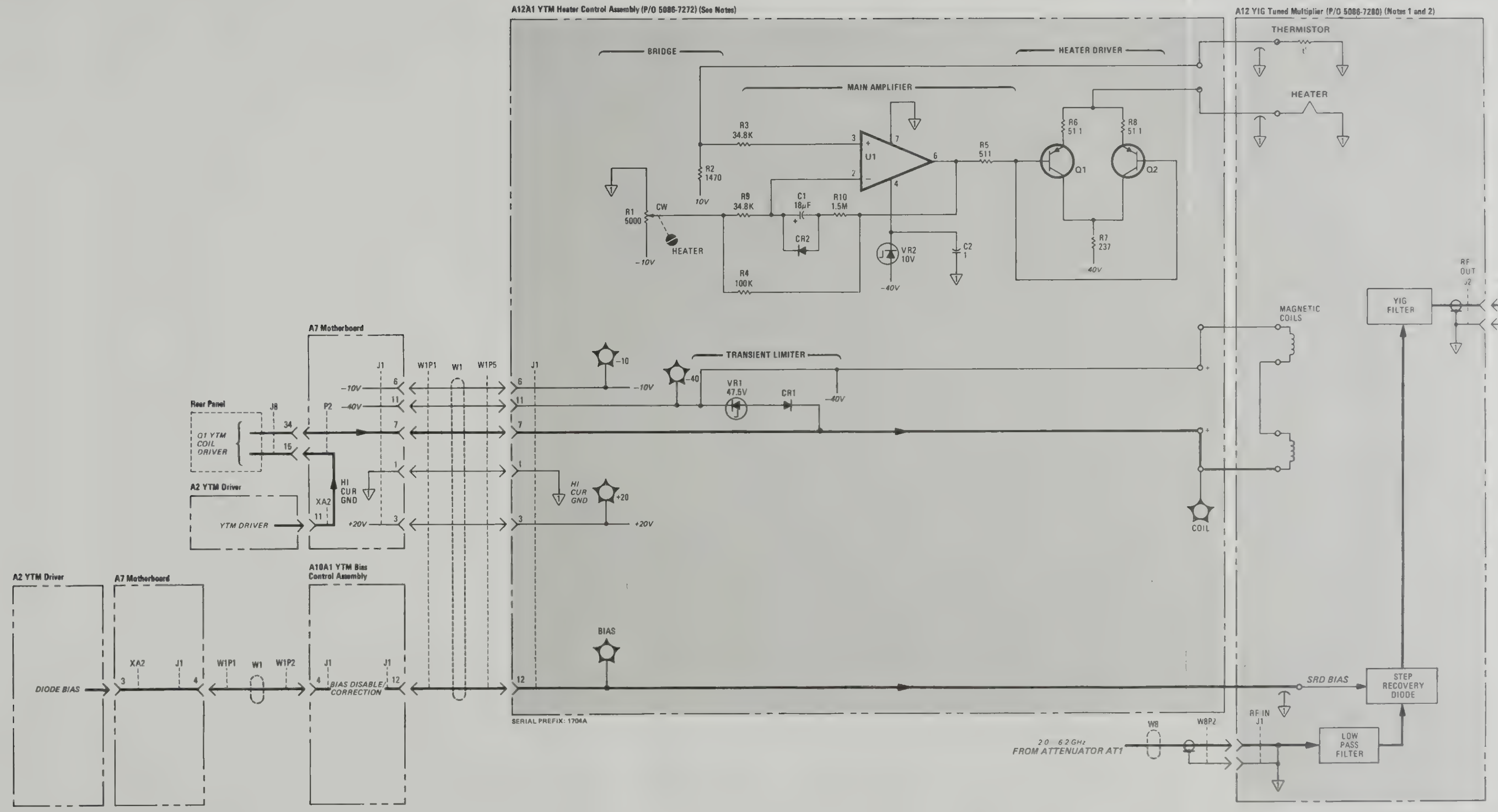


Figure 8-36. A12A1 YTM Heater Control Assembly, Component Locations



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION

2. THE YIG TUNED MULTIPLIER (YTM) A12 IS NON FIELD REPAIRABLE. WHEN REPLACING THE YTM, THE YTM BIAS BOARD A12A1 AND A12 ARE REPLACED AS A UNIT WITH HP PART NO. 5086-7272

3. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS, CAPACITANCE IN MICROFARADS

REFERENCE DESIGNATIONS

NO PREFIX	A7	A12A1
J8	J1 P2 XA1, XA2	C1, C2 CR1, CR2 J1
	A12	Q1, Q2 R1, R10 U1
W1, W8, W9 W1P1 W1P5 W8P2 W9P2	J1, J2	VR1, VR2

10
A12, A12A1

Figure 8-37. A12A1 YTM Heater Control Assembly, Schematic

SERVICE SHEET 9

A10A YTM BIAS CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

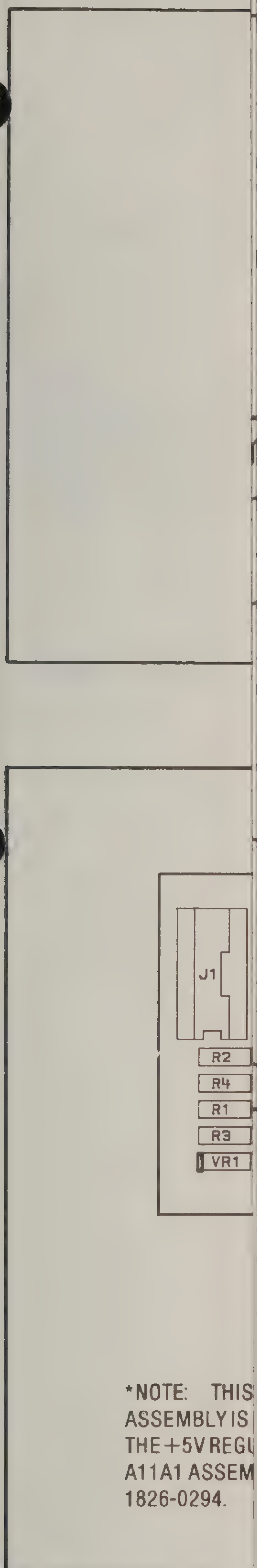
General Description

The A10A1 YTM Bias Assembly contains the necessary circuitry to disable the YTM bias when using modulation or RF Blanking. It also routes the YTM Bias to the YTM from the A2 YTM Driver Assembly.

Bias Correction and Disable

With Band 1 selected and no modulation, −4V holds Q1 OFF and the bias disable circuit is open. The −4V at the cathode of CR2 is less than the voltage at CR1 so the resulting voltage at CR3 cathode is approximately −4V. With modulation ON, Q2 and Q3 turn ON driving U2 pin 3 positive. The positive voltage from U2 disables the bias.

When Band 2 or 3 is selected, Q1 is biased ON and the bias disable circuit Q2 and Q3 is shorted out. The YTM diode bias, typically 0V to +0.5V, is applied to the cathode of CR2. The modulation drive signal at the U1 inverting input is compared with an adjustable offset voltage applied to the noninverting input. The gain of U1 is −1 and the output is inverted. When the voltage at CR1 becomes less than the voltage at CR2, the voltage coupled into U2 is approximately the voltage output of U1. The output voltage from U2 is such that as it decreases, the attenuation is increasing, and thus the power becomes less. The modulator starts to attenuate at approximately +0.4V. The voltage at U2 pin 3 will also begin to decrease. The OFFSET adjustment A10A1R4 is set to obtain maximum attenuation at −5 dBm. This allows minimum power into the YTM and produces maximum efficiency.

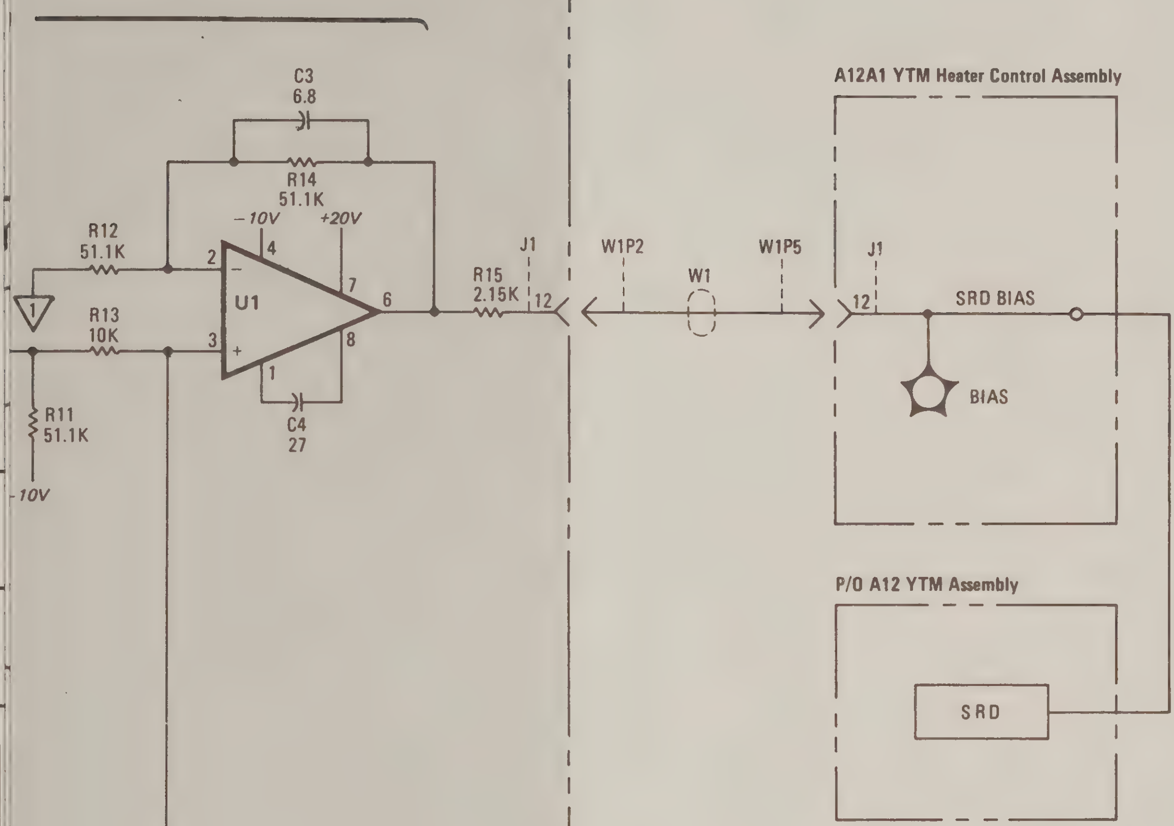


Figure

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPITANCE IN PICOFARADS.



REFERENCE DESIGNATORS

NO PREFIX	A10A1
A1, A2, A7 A10, A12A1 W1 W1P1, W1P2 W1P5	C1-C4 CR1-CR3 Q1-Q3 R1-R16 U1, U2

9

A10A1

Figure 8-35. A10A1 YTM Bias Control Assembly, Schematic

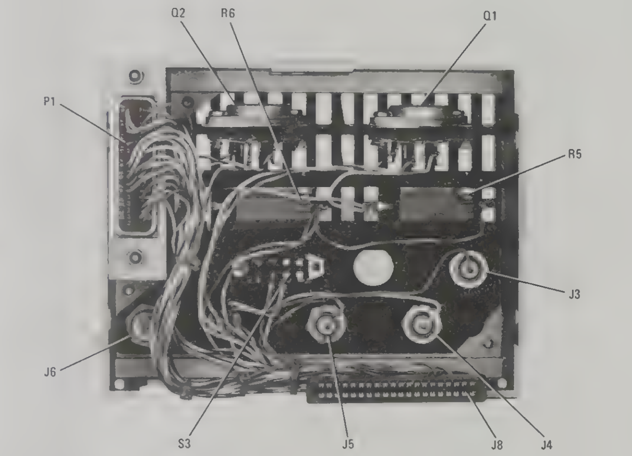
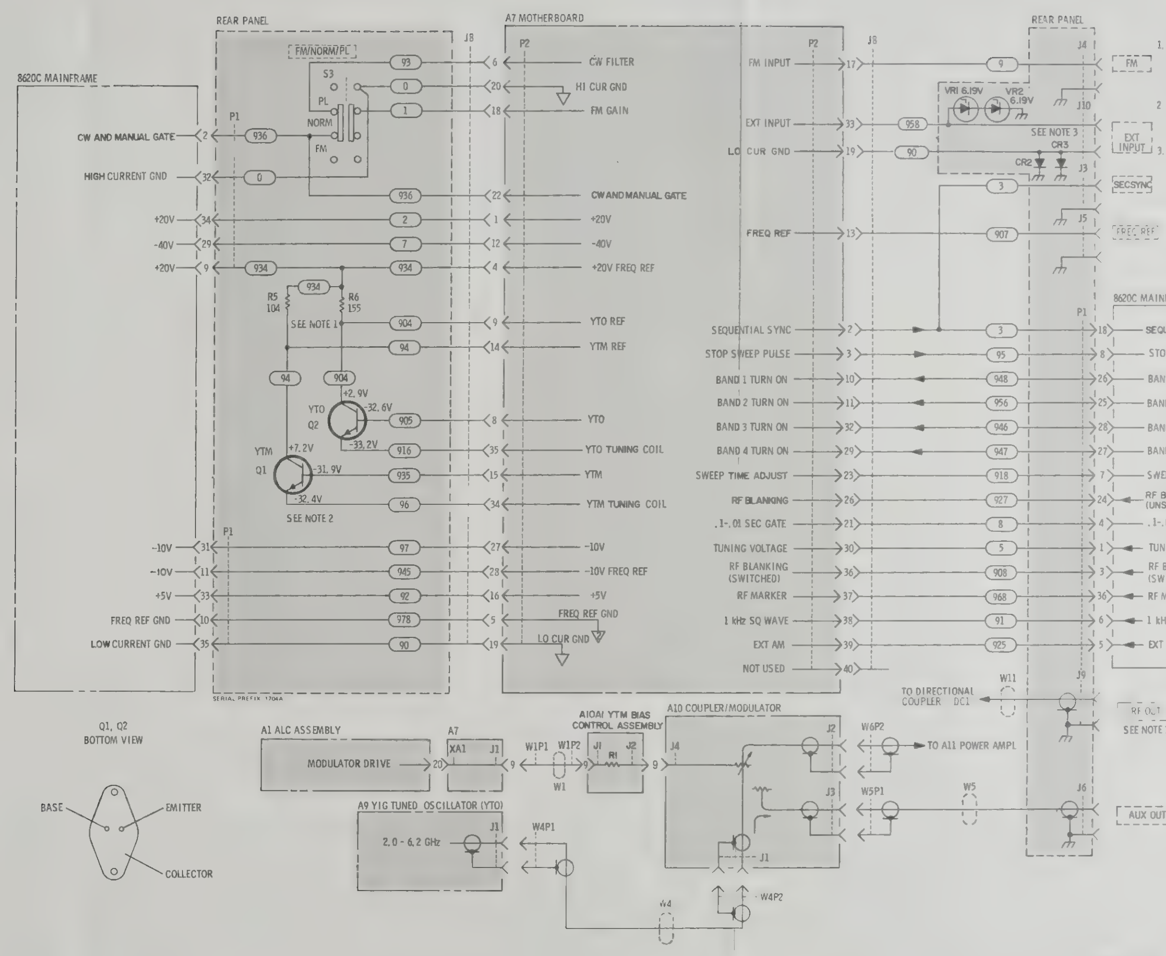


Figure 8-39. Rear Panel, Component Locations



NOTES

1. THE FREQUENCY REFERENCE RESISTORS, R5 AND R6, ARE A MATCHED PAIR AND BOTH MUST BE REPLACED IF EITHER ONE FAILS
2. Q1 AND Q2 ARE MOUNTED ON THE REAR PANEL (HP PART NO. 86290-20003) WHICH IS ALSO THE HEAT SINK.
3. WHEN OPTION 004 IS INSTALLED J9(RF OUT) AND J10(ALC EXT. INPUT) ARE MOUNTED ON REAR PANEL

11
A1,A7,A9,A10

Figure 8-40. Rear Panel Wiring Diagram

SERVICE SHEET 10

A12A1 YTM HEATER CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

General Description

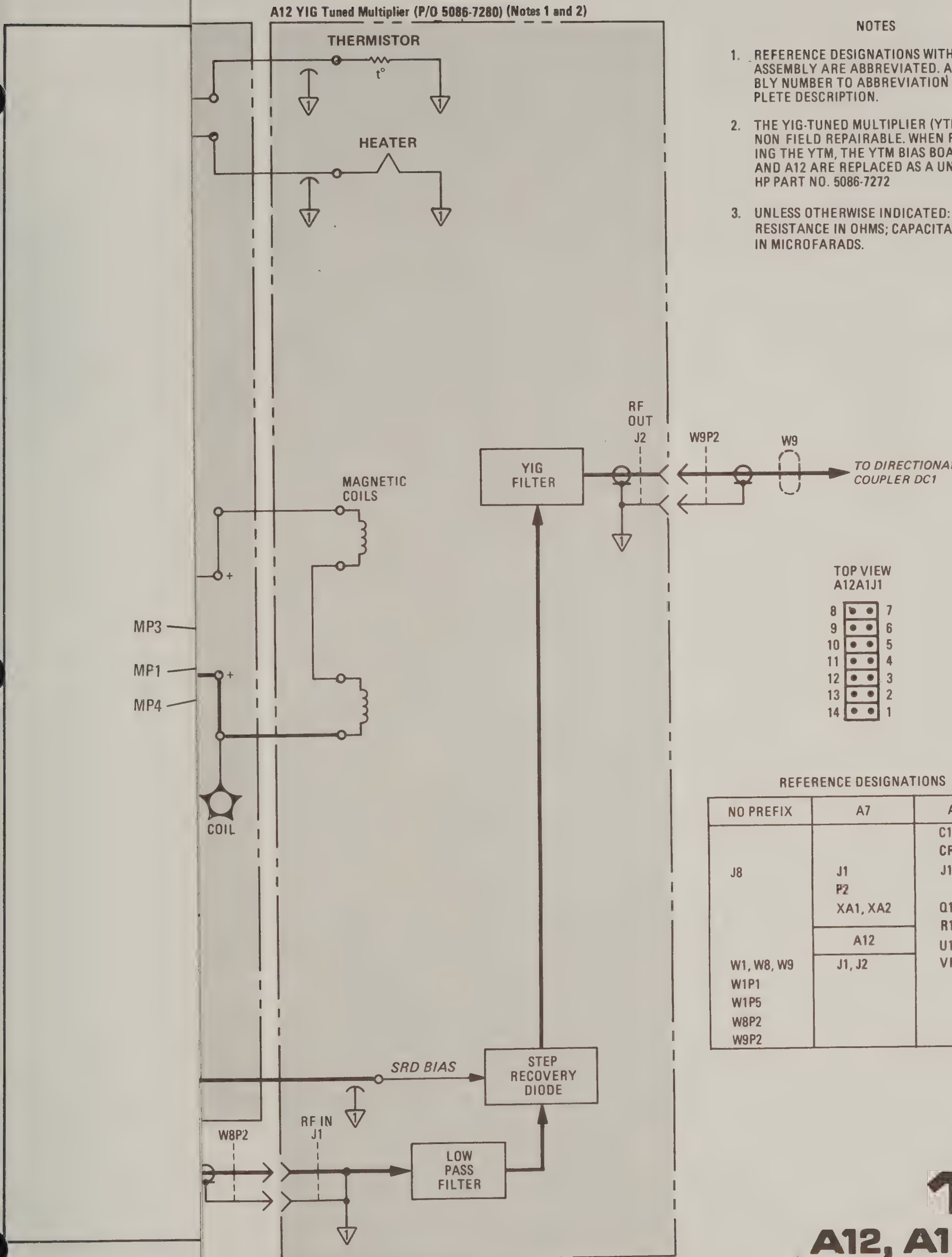
The A12A1 YTM Heater Control has two basic functions: 1) to provide temperature compensation to the A12 YTM Assembly and 2) to limit transient voltage spikes caused by Band 4 switch points.

Heater Driver

The YTM YIG-Filter is temperature compensated in two ways. First, the YIG sphere is mounted near a crystalline axis to reduce temperature dependence. Then, during operation, the entire YIG-Filter Assembly is heated to a constant 75°C as set by HEATER adjustment R1. The temperature is monitored by a bead thermistor near the YIG sphere. The thermister is one leg of a bridge network and supplies a control signal to the main amplifier U1 if changes in temperature unbalance the bridge. The output of U1 is dc coupled to the Heater Drive Q1/Q2 which drives the resistive heater element.

Transient Limiter

Negative spikes of voltage are limited to −88V by the Transient Limiter circuit CR1 and VR1. The voltage transients occur at band-switch points in Band 4 and during retrace.



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. THE YIG-TUNED MULTIPLIER (YTM) A12 IS NON FIELD REPAIRABLE. WHEN REPLACING THE YTM, THE YTM BIAS BOARD A12A1 AND A12 ARE REPLACED AS A UNIT WITH HP PART NO. 5086-7272
3. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.

REFERENCE DESIGNATIONS

NO PREFIX	A7	A12A1
J8	J1 P2 XA1, XA2	C1, C2 CR1, CR2 J1 Q1, Q2 R1, R10 U1 VR1, VR2
W1, W8, W9 W1P1 W1P5 W8P2 W9P2	**A12** J1, J2	

10

A12, A12A1

Figure

Figure 8-37. A12A1 YTM Heater Control Assembly, Schematic

RF SECTION REMOVAL PROCEDURE

1. Remove A1, A2, A3, and A4 boards 1
2. With a 1/4-inch open-end wrench, disconnect gray cable W2 from A1 board, and blue cable W3 from A4 board.
3. Remove two pozi-drive screws 2 that secure RF Section to PC board mounting plate.
4. Remove straight-slot screw holding RF Plug-In latching handle 3 . Remove handle, washer, and spring 4 Note placement and position of spring and hole for reinstalling.
5. With a 5/16-inch open-end wrench: Disconnect RF Cable W10 7 at rear of RF OUTPUT connector J1 (front panel) and RF Cable W5 9 at rear of AUX OUT connector J6 (rear panel). W10 and W5 are removed by disconnecting subminiature SMA connectors at the rear of each output connector. If Option 004 is installed, disconnect RF Cable W11 at rear of RF OUT connector J9 (rear panel).
6. Remove four flat-head, pozi-drive, front-panel mounting screws 5 (two from each side).
7. Remove two flat-head, pozi-drive, rear-panel mounting screws 6 .
8. Disconnect flexible cable W1 8 .
9. Lay RF Plug-In on right side, tilt front panel outward, and carefully slide RF Section from the plug-in.

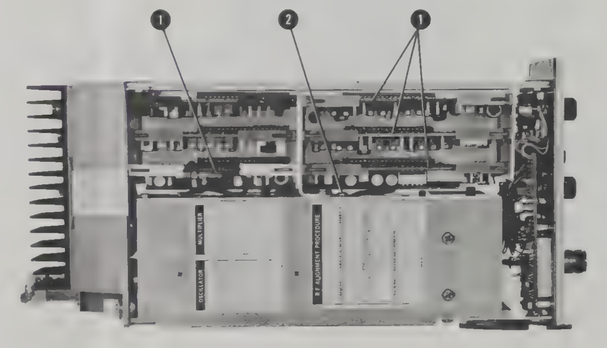


Figure 8-42. RF Section Removal and Installation Procedure (1 of 3)

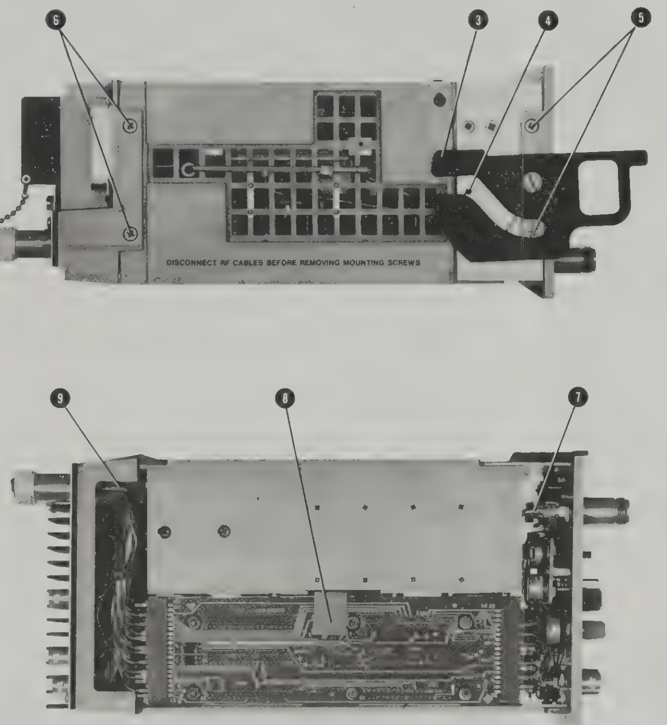


Figure 8-42. RF Section Removal and Installation Procedure (2 of 3)

RF SECTION INSTALLATION PROCEDURE

NOTE

Before installing the RF Section, be sure the two flat-head, pozi-drive screws 5 located on the right side, have been removed. This ensures that the front panel is free to move as the RF Section is installed in the plug-in.

1. Lay RF Plug-In on right side, tilt front panel outward, and slide RF Section into the plug-in.

NOTE

Ensure that the flexible cable W1 extends out the bottom, and that cables W2 and W3 extend into the PC board compartment.

CAUTION

To prevent bending the RF cables (W5 9 and W10 7 , or W11 if Option 004 is installed) and possible breakage of center conductors, insert the RF cables into their respective connectors before installing RF Section mounting screws 5 and 6 .

2. Connect RF Cable W5 9 to subminiature SMA connector.
3. Loosely install flat-head, pozi-drive screws 6 for support.
4. Connect RF Cable W10 7 , or W11 if Option 004 is installed, to subminiature SMA connector.
5. Install all four flat-head, pozi-drive screws 5 on left and right sides.
6. Secure flat-head, pozi-drive screws 6 .
7. Install spring 4 and latch handle 3 on left side of plug-in. Ensure that washer is in position before latch handle is mounted. Latch handle should turn freely after straight-slot screw is tightened.
8. Connect flexible cable W1 to Master Board connector J1.
9. Install two pozi-drive screws 2 .
10. Connect gray cable W2 to ALC Board connector A1J1 and install A1 board.
11. Connect blue cable W3 to FM Board connector A4J1 and install A4 board.
12. Install A2 and A3 boards.

Figure 8-42. RF Section Removal and Installation Procedure (3 of 3)

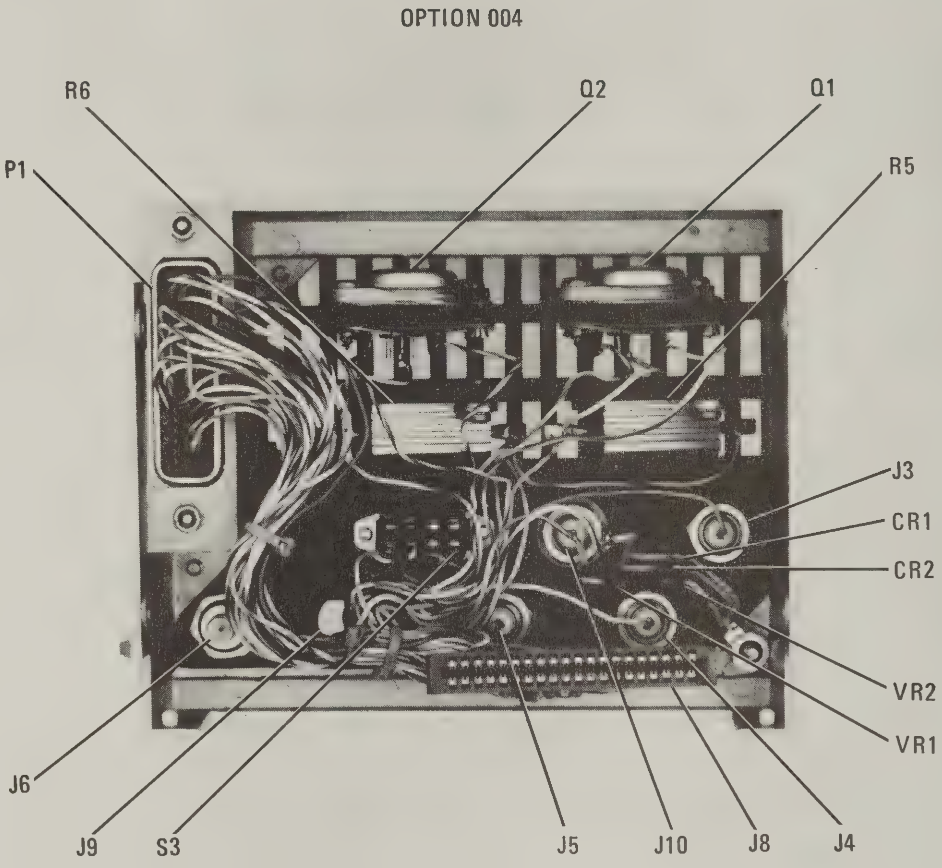
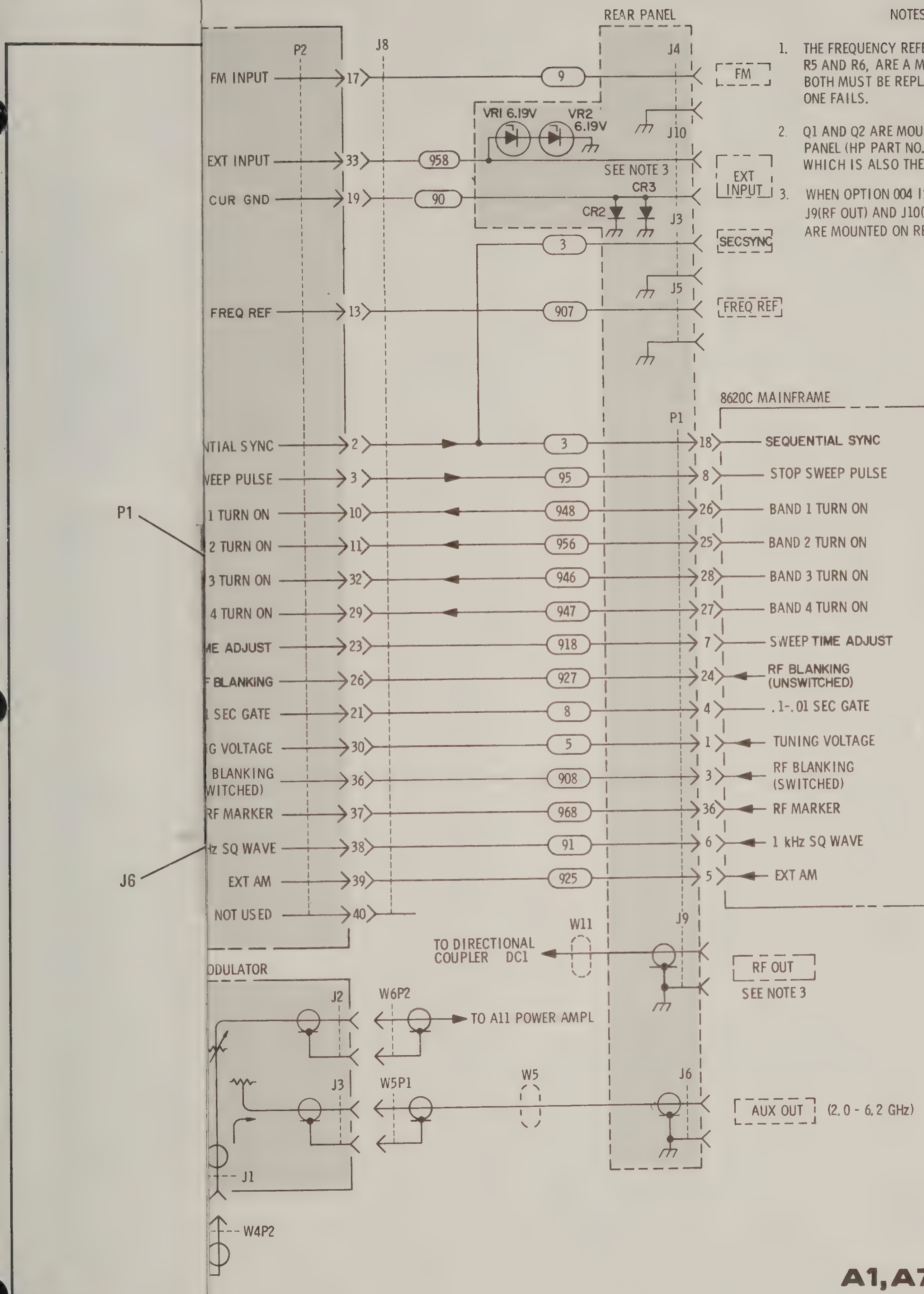


Figure 8-38. Rear Panel, Component Locations, Option 004

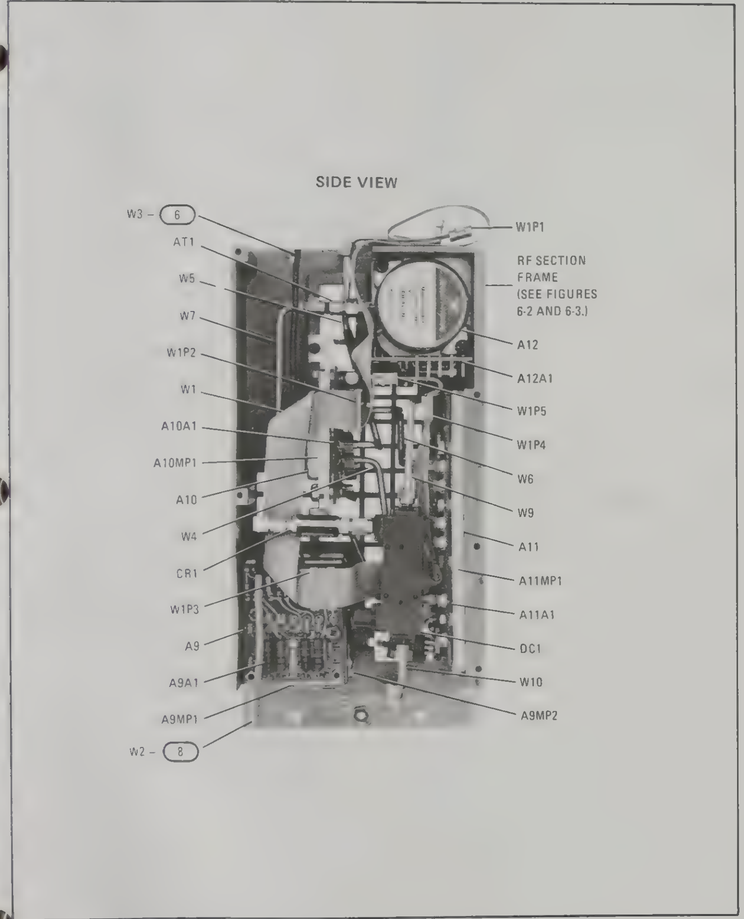


NOTES

1. THE FREQUENCY REFERENCE RESISTORS, R5 AND R6, ARE A MATCHED PAIR AND BOTH MUST BE REPLACED IF EITHER ONE FAILS.
2. Q1 AND Q2 ARE MOUNTED ON THE REAR PANEL (HP PART NO. 86290-20003) WHICH IS ALSO THE HEAT SINK.
3. WHEN OPTION 004 IS INSTALLED, J9(RF OUT) AND J10(ALC EXT. INPUT) ARE MOUNTED ON REAR PANEL.

11
A1,A7,A9,A10

Figure 8-40. Rear Panel Wiring Diagram



Replacement Figure 8-44. RF Section, Major Assembly and Component Location

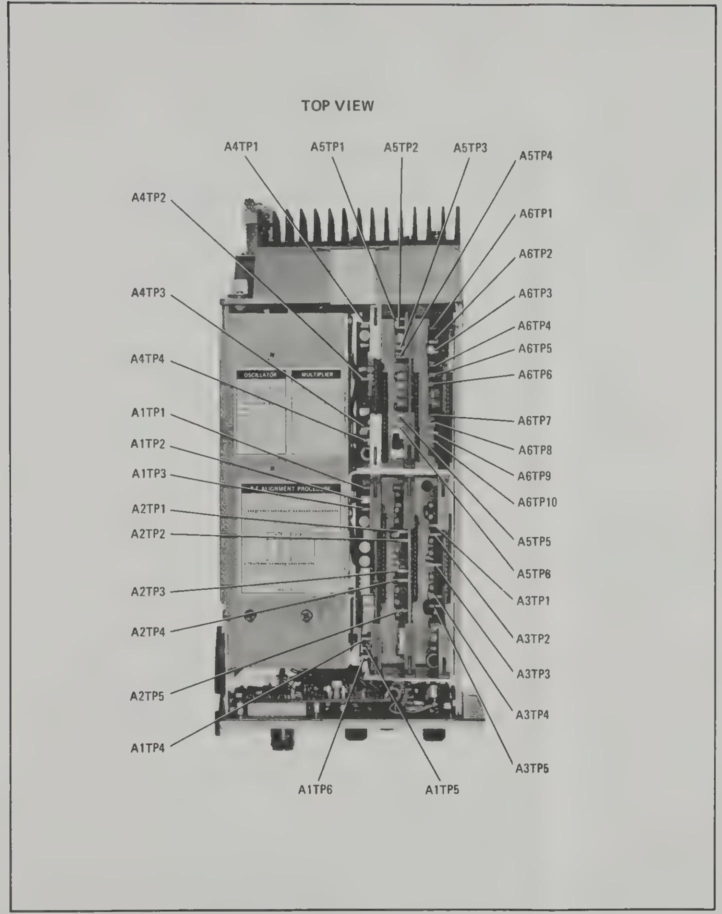


Figure 8-45. 86290B Test Point Locations

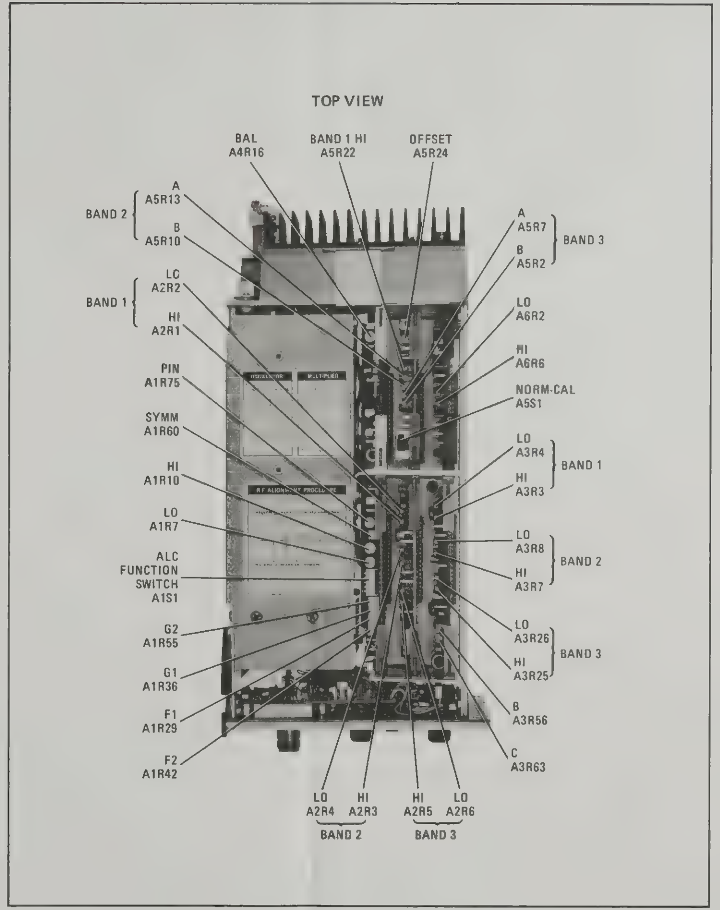


Figure 8-46. 86290B Adjustment Locations

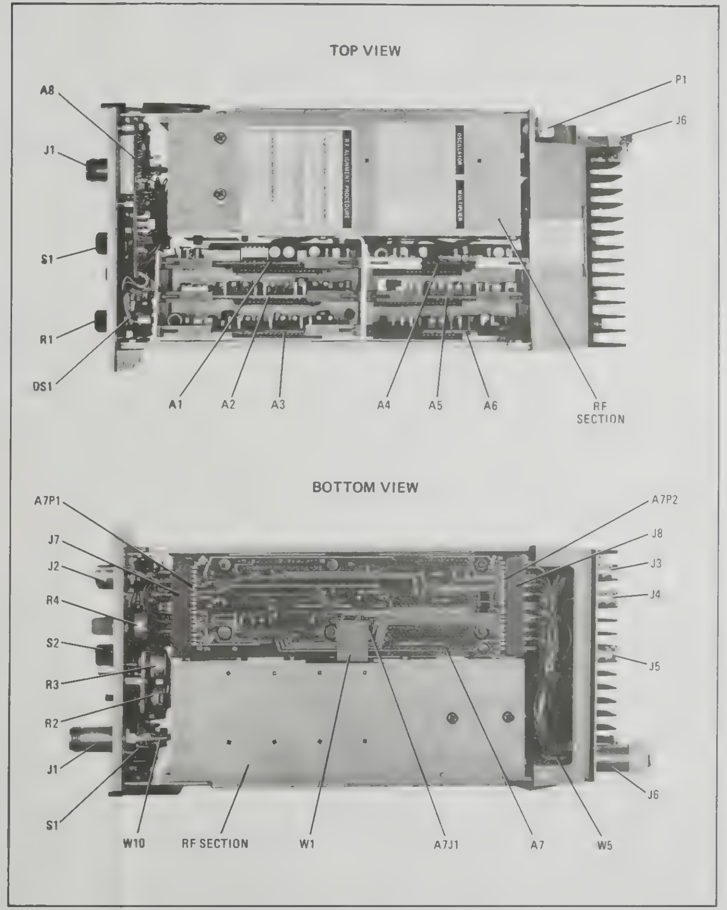


Figure 8-47. 86290B Major Assembly and Component Locations

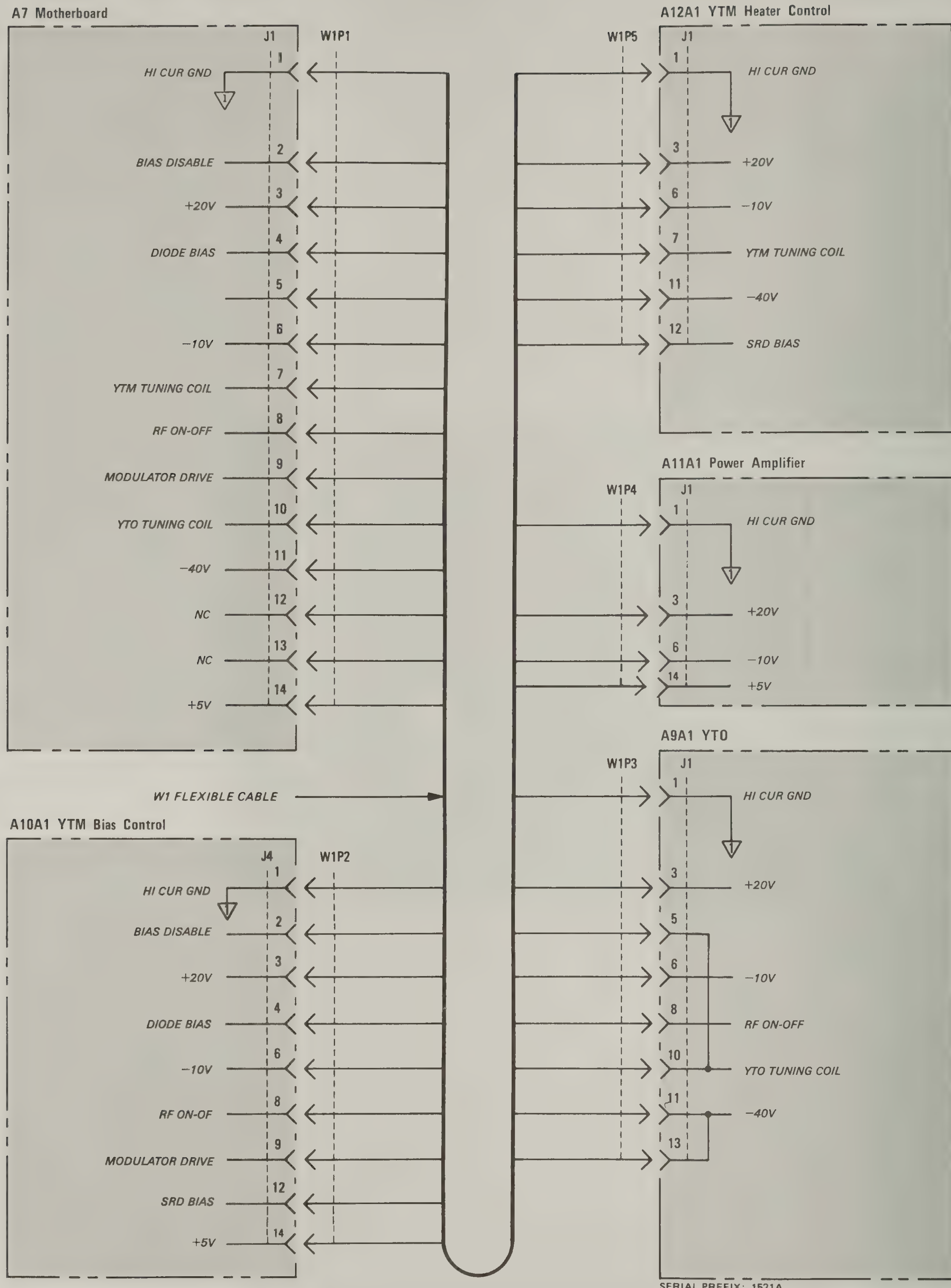
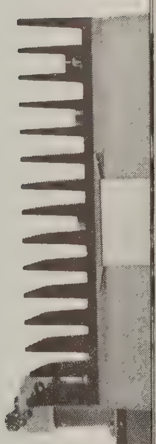


Figure 8-41. W1 Flexible Cable Assembly

RF SECTION

1. Remove A1
2. With a 1/4- from A4 bo
3. Remove tw
4. Remove st and spring
5. With a 5/16 nector J1 (f W10 and W put connect J9 (rear pa
6. Remove fo
7. Remove tw
8. Disconnect
9. Lay RF Plu plug-in.



Fig

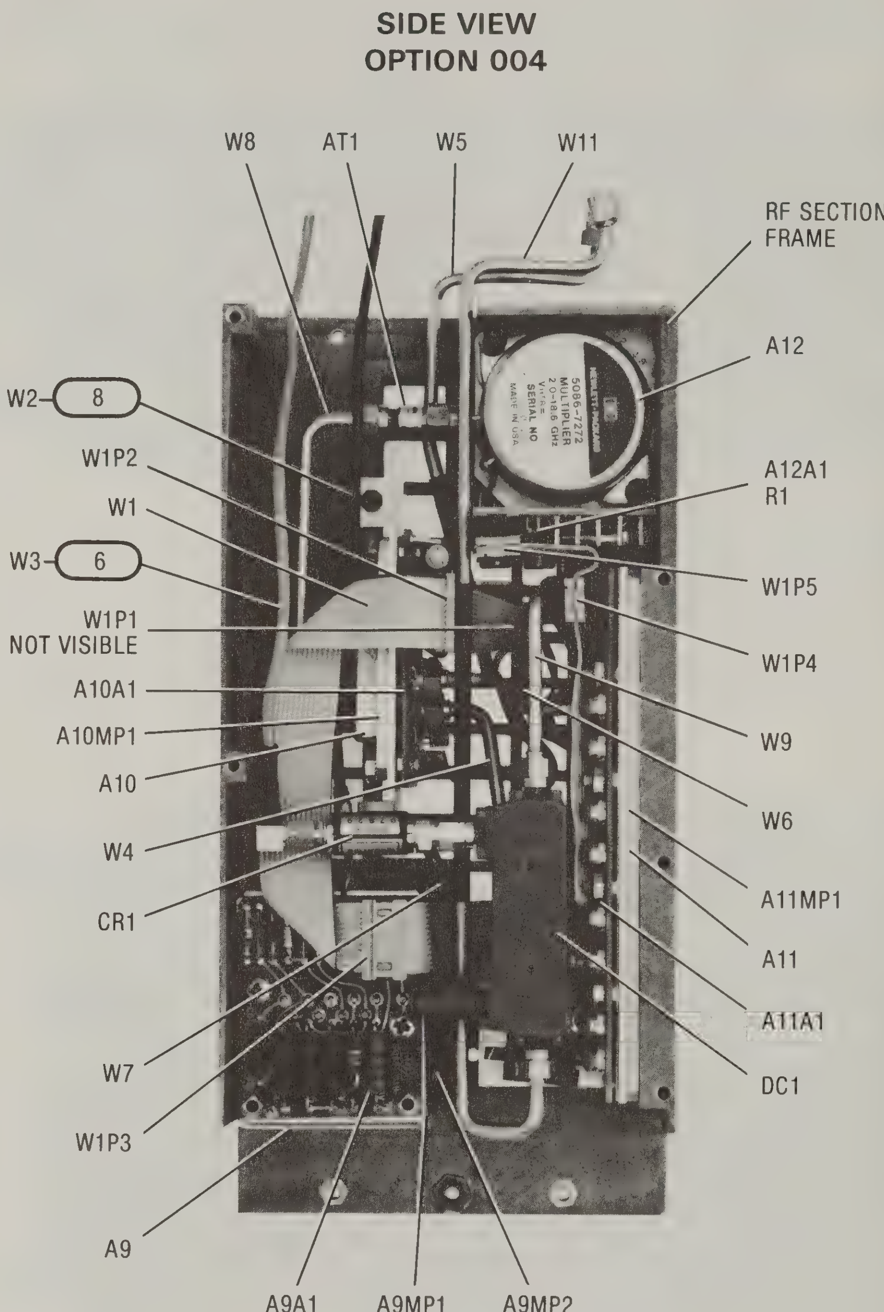


Figure 8-43. RF Section, Major Assembly and Component Locations, Option 004

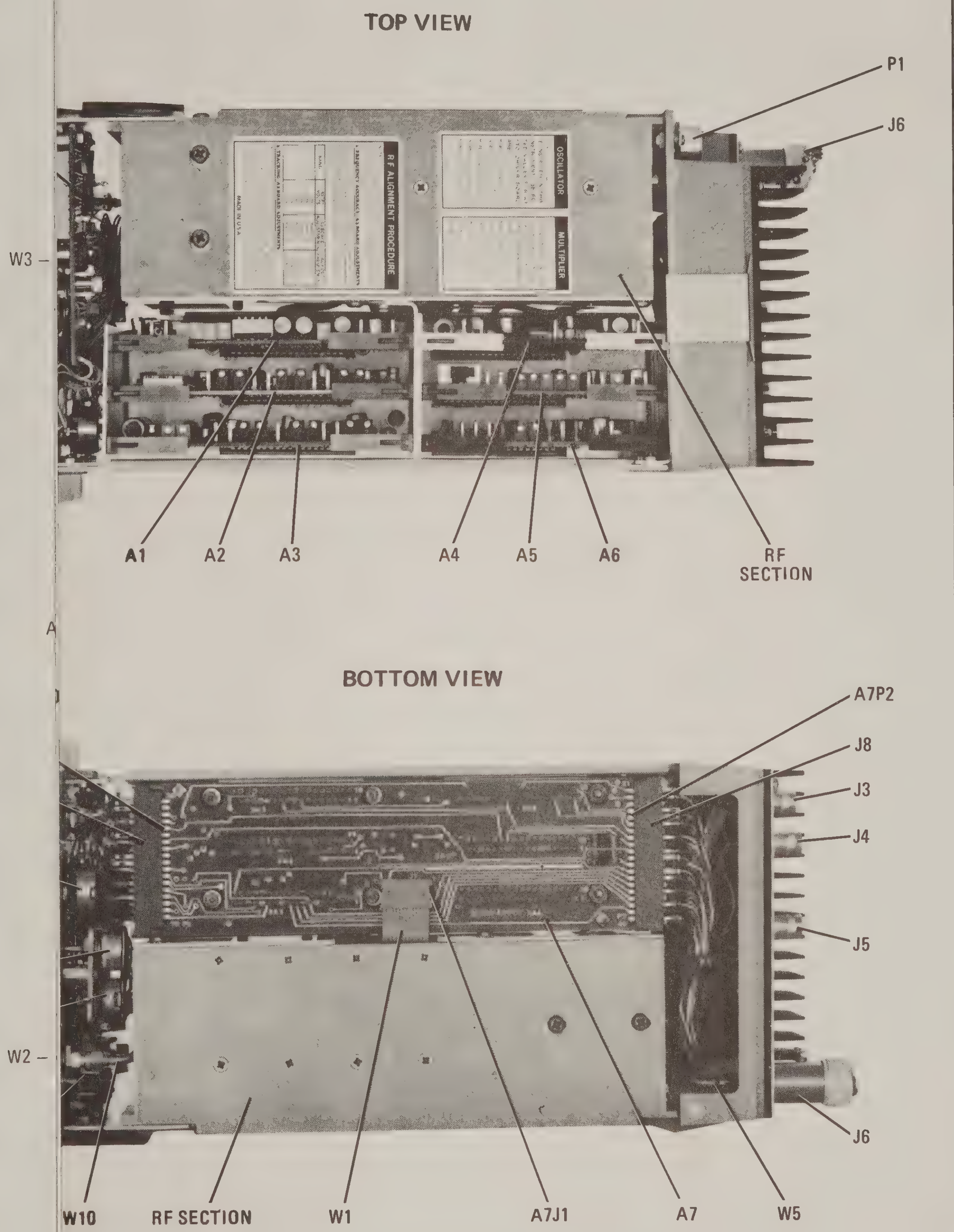


Figure 8-47. 86290B Major Assembly and Component Locations

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Telex: 4510 ARENTA DR (RCA) P

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(Olarinluoma 7)
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Rue de la Commune de Paris
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Boite Postale 56
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Hewlett-Packard GmbH
Geschäftsstelle
Herrenberger Strasse 130
D-7030 **BÖBLINGEN**
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Geschäftsstelle
Emanuel-Leutze-Strasse 1
D-4000 **DUSSELDORF**
Tel: (0211) 5971-1
Telex: 085/86 533 hpdd d
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Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND**-Aplerbeck
Tel: (0231) 45001

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 **FRANKFURT** 56
Tel: (0611) 50-04-1
Telex: 04 13249 hpffm d
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Hewlett-Packard GmbH
Geschäftsstelle
Aussenstelle Bad Homburg
Louisenstrasse 115
D-6380 **BAD HOMBURG**
Tel: (06172) 109-0

Hewlett-Packard GmbH
Geschäftsstelle
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
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Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (0511) 5706-0
Telex: 092 3259
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Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: (0621) 70050
Telex: 0462105
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Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
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Telex: 0712816 HP ULM-D
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Ehhericherstr. 13
D-8500 **NÜRNBERG** 10
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See United Kingdom

GREECE

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***ATHENS** 133*
Tel: 32 30 303, 32 37 371
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PLAISIO S.A.
G. Gerardos
24 Stournara Street
ATHENS
Tel: 36-11-160
Telex: 221871
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GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 314786
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HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
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199-203 Hennessy Rd.
*Wanchia, **HONG KONG***
Tel: 5-729376
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Connaught Road, C.
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Tel: 5-455644
Telex: 74766 SCHMX HX
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Hafnarnvoli-Tryggvagotu
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16, Ohaliav St.
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Telex: 25231 AB/PAKRD IL
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Electronics Engineering Division
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16 Kremenetski Street
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6-11, Hon-dori, Naka-ku
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Tel: 82-241-0611

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Towa Building
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KOBE, 650
Tel: (078) 392-4791
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KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
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614, Higashi-Shiokoji-cho
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MITO, Ibaraki 310
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Nakamura-ku
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Yodogawa-ku
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Shinjuku-ku,**TOKYO** 160
Tel: 03-348-4611
CH,E

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Suginami-ku **TOKYO** 168
Tel: (03) 331-611
Telex: 232-2024 YHPTOK
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Daiichi Asano Building
2-8, Odori, 5 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 25-7155
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30-4 Tsuruya-cho, 3 Chome
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P.O. Box 165.167
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Lot 6624, Section 64
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Av. Periferico Sur No. 6501
Tepepan, Xochimilco
16020 **MEXICO D.F.**
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Hewlett-Packard Mexicana, S.A. de C.V.
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Col. del Valle
Municipio de Garza Garcia
MONTERREY, Nuevo Leon
Tel: 78 42 41
Telex: 038 410
CH

ECISA
José Vasconcelos No. 218
Col. Condesa Deleg. Cuauhtémoc
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Tel: 553-1206
Telex: 17-72755 ECE ME
M

MOROCCO
Dolbeau
81 rue Karatchi
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272093, 272095
Telex: 23 739
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NETHERLANDS
Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL 1181KK **AMSTELVEEN**
P.O. Box 667
NL1180 AR **AMSTELVEEN**
Tel: (020) 47-20-21
Telex: 13 216 HEPA NL
A,CH,CM,CS,E,MP,P

Hewlett-Packard Nederland B.V.
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NL 2900AA **CAPELLE A/D IJSSEL**
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A,CH,CS,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV **EINDHOVEN**
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: (040) 326911
Telex: 51484 hepae nl
A,CH**,E,M

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: 687-159
Cable: HEWPACK Auckland
CH,CM,E,P*

Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, **WELLINGTON 3**
P.O. Box 9443
Courtenay Place, **WELLINGTON 3**
Tel: 877-199
Cable: HEWPACK Wellington
CH,CM,E,P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 486-928
Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Ghuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A,M

NORTHERN IRELAND
See United Kingdom

NORWAY
Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 16621 hpnas n
CH,CS,E,MS

Hewlett-Packard Norge A/S
Österndalen 16-18
P.O. Box 34
N-1345 **ÖSTERÅS**
Tel: 0047/2/17 11 80
Telex: 16621 hpnas n
A,CH,CM,CS,E,M,P

OMAN
Khimjil Ramdas
P.O. Box 19
MUSCAT
Tel: 722225, 745601
Telex: 3289 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT
Tel: 734 201-3
Telex: 3274 BAHWAN MB

PAKISTAN
Mushko & Company Ltd.
1-B, Street 43
Sector F-8/1
ISLAMABAD
Tel: 51071
Cable: FEMUS Rawalpindi
A,E,M

Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
***KARACHI** 0302*
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
*A,E,M,P**

PANAMA
Electrónico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 63-6613, 63-6748
Telex: 3483 ELECTRON PG
A,CM,E,M,P

PERU
Cía Electro Médica S.A.
Los Flamencos 145, San Isidro
Casilla 1030
***LIMA** 1*
Tel: 41-4325, 41-3703
Telex: Pub. Booth 25306
CM,E,M,P

PHILIPPINES
The Online Advanced Systems Corporation
Rico House, Amorsolo Cor. Herrera Street
Legaspi Village, Makati
P.O. Box 1510
*Metro **MANILA***
Tel: 85-35-81, 85-34-91, 85-32-21
Telex: 3274 ONLINE
A,CH,CS,E,M

Electronic Specialists and Proponents Inc.
690-B Epifanio de los Santos Avenue
*Cubao, **QUEZON CITY***
P.O. Box 2649 Manila
Tel: 98-96-81, 98-96-82, 98-96-83
Telex: 40018, 42000 ITT GLOBE MACKAY BOOTH
P

PORTUGAL
Mundinter
Intercambio Mundial de Comércio S.A.R.L.
P.O. Box 2761
Av. Antonio Augusto de Aguiar 138
P-LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M

Soquimica
Av. da Liberdade, 220-2
*1298 **LISBOA** Codex*
Tel: 56 21 81/2/3
Telex: 13316 SABASA
P

Telectra-Empresa Técnica de Equipmentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
***P-LISBON** 1*
Tel: (19) 68-60-72
Telex: 12598
CH,CS,E,P

PUERTO RICO
Hewlett-Packard Puerto Rico
Ave. Muñoz Rivera #101
Esq. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800

Hewlett-Packard Puerto Rico
Calle 272 Edificio 203
Urb. Country Club
RIO PIEDRAS, Puerto Rico
P.O. Box 4407
CAROLINA, Puerto Rico 00628
Tel: (809) 762-7255
A,CH,CS

QATAR
Computearbia
P.O. Box 2750
DOHA
Tel: 883555
Telex: 4806 CHPARB
P

Eastern Technical Services
P.O.Box 4747
DOHA
Tel: 329 993
Telex: 4156 EASTEC DH

Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 22170, 23539
Telex: 4439 NASSER DH
M

SAUDI ARABIA
Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
Thuobah
AL-KHOBAR
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 38 48
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O.Box 22015
RIYADH
Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
CH,CS,E,M

Abdul Ghani El Ajou
P.O. Box 78
RIYADH
Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND
See United Kingdom

SINGAPORE
Hewlett-Packard Singapore (Sales) Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
P.O. Box 58 Alexandra Rd. Post Office
SINGAPORE, 9115
Tel: 631788
Telex: HPSGSO RS 34209
Cable: HEWPACK, Singapore
A,CH,CS,E,MS,P

SALES & SUPPORT OFFICES
Arranged alphabetically by country

SINGAPORE (Cont'd)
Dynamar International Ltd.
Unit 05-11 Block 6
Kolam Ayer Industrial Estate
***SINGAPORE** 1334*
Tel: 747-6188
Telex: RS 26283
CM

SOUTH AFRICA
Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place **CAPE PROVINCE** 7450
Pine Park Center, Forest Drive,
Pinelands
CAPE PROVINCE 7405
Tel: 53-7954
Telex: 57-20006
A,CH,CM,E,MS,P

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 37099
92 Overport Drive
DURBAN 4067
Tel: 28-4178, 28-4179, 28-4110
Telex: 6-22954
CH,CM

Hewlett-Packard So Africa (Pty.) Ltd.
6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6000
Tel: 041-302148
CH

Hewlett-Packard So Africa (Pty.) Ltd.
P.O.Box 33345
Glenstantia 0010 **TRANSVAAL**
1st Floor East
Constantia Park Ridge Shopping
Centre
Constantia Park
PRETORIA
Tel: 982043
Telex: 32163
CH,E

Hewlett-Packard So Africa (Pty.) Ltd.
Private Bag Wendywood
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877
Cable: HEWPACK Johannesburg
A,CH,CM,CS,E,MS,P

SPAIN
Hewlett-Packard Española S.A.
Calle Entenza, 321
E-**BARCELONA** 29
Tel: 322.24.51, 321.73.54
Telex: 52603 hpbee
A,CH,CS,E,MS,P

Hewlett-Packard Española S.A.
Calle San Vicente S/No
Edificio Albia II
E-**BILBAO** 1
Tel: 423.83.06
A,CH,E,MS

Hewlett-Packard Española S.A.
Crta. de la Coruña, Km. 16, 400
Las Rozas
E-**MADRID**
Tel: (1) 637.00.11
CH,CS,M

Hewlett-Packard Española S.A.
Avda. S. Francisco Javier, S/no
Planta 10. Edificio Sevilla 2,
E-**SEVILLA** 5
Tel: 64.44.54
Telex: 72933
A,CS,MS,P

Hewlett-Packard Española S.A.
Calle Ramon Gordillo, 1 (Entlo.3)
E-**VALENCIA** 10
Tel: 361-1354
CH,P

SWEDEN
Hewlett-Packard Sverige AB
Sunnanvagen 14K
S-22226 **LUND**
Tel: (046) 13-69-79
Telex: (854) 17886 (via Spånga office)
CH

Hewlett-Packard Sverige AB
Östra Tullgatan 3
S-21128 **MALMÖ**
Tel: (040) 70270
Telex: (854) 17886 (via Spånga office)

Hewlett-Packard Sverige AB
Våstra Vintergatan 9
S-70344 **ÖREBRO**
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga office)
CH

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 **SPÅNGA**
Tel: (08) 750-2000
Telex: (854) 17886
Telefax: (08) 7527781
A,CH,CM,CS,E,MS,P

Hewlett-Packard Sverige AB
Frötallisgatan 30
S-42132 **VÄSTRA-FRÖLUNDA**
Tel: (031) 49-09-50
Telex: (854) 17886 (via Spånga office)
CH,E,P

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 **BASEL**
Tel: (61) 33-59-20
A

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case Postale 365
CH-1217 **MEYRIN** 2
Tel: (0041) 22-83-11-11
Telex:27333 HPAG CH
CH,CM,CS

Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 **WIDEN**
Tel: (0041) 57 31 21 11
Telex: 53933 hpag ch
Cable: HPAG CH
A,CH,CM,CS,E,MS,P

SYRIA
General Electronic Inc.
Nuri Basha Ahnaf Ebn Kays Street
P.O. Box 5781
DAMASCUS
Tel: 33-24-87
Telex: 411 215
Cable: ELECTROBOR DAMASCUS
E

Middle East Electronics
P.O.Box 2308
Abu Rumnaneh
DAMASCUS
Tel: 33 4 5 92
Telex: 411 304
M

TAIWAN
Hewlett-Packard Far East Ltd.
Kaohsiung Office
2/F 68-2, Chung Cheng 3rd Road
KAOHSIUNG
Tel: (07) 241-2318
CH,CS,E

Hewlett-Packard Far East Ltd.
Taiwan Branch
8th Floor
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable:HEWPACK Taipei
A,CH,CM,CS,E,M,P

Ing Lih Trading Co.
3rd Floor, 7 Jen-Ai Road, Sec. 2
TAIPEI 100
Tel: (02) 3948191
Cable: INGLIH TAIPEI
A

THAILAND
Unimesa
30 Patpong Ave., Suriwong
***BANGKOK** 5*
Tel: 235-5727
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok
A,CH,CS,E,M

Bangkok Business Equipment Ltd.
5/5-6 Dejo Road
BANGKOK
Tel: 234-8670, 234-8671
Telex: 87669-BEQUIPT TH
Cable: BUSIQUIPT Bangkok
P

TRINIDAD & TOBAGO
Caribbean Telecoms Ltd.
50/A Jerningham Avenue
P.O. Box 732
PORT-OF-SPAIN
Tel: 62-44213, 62-44214
Telex: 235,272 HUGCO WG
CM,E,M,P

TUNISIA
Tunisie Electronique
31 Avenue de la Liberte
TUNIS
Tel: 280-144
E,P

Corema
1 ter. Av. de Carthage
TUNIS
Tel: 253-821
Telex: 12319 CABAM TN
M

TURKEY
Teknim Company Ltd.
Iran Caddesi No. 7
*Kavaklidere, **ANKARA***
Tel: 275800
Telex: 42155 TKNM TR
E

E.M.A.
Medina Eldem Sokak No.41/6
Yuksel Caddesi
ANKARA
Tel: 175 622
Telex: 42 591
M

UNITED ARAB EMIRATES
Emitac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 82 04 19-20
Cable: EMITAC ABUDHABI

Emitac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591 181
Telex: 68136 Emitac Sh
CH,CS,E,M,P

UNITED KINGDOM

GREAT BRITAIN
Hewlett-Packard Ltd.
Trafalgar House
Navigation Road
ALTRINCHAM
Cheshire WA14 1NU
Tel: 061 928 6422
Telex: 668068
A,CH,CS,E,M,MS,P

Hewlett-Packard Ltd.
Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
Telex: 8952716
E,CH,CS,P

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton **BRISTOL**, Avon BS8 2BN
Tel: 0272 736806
Telex: 444302
CH,CS,E,P

Hewlett-Packard Ltd.
Bridewell House
Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
CH,CS,P

Hewlett-Packard Ltd.
Fourier House
257-263 High Street
LONDON COLNEY
Herts. AL2 1HA, St. Albans
Tel: 0727 24400
Telex: 1-8952716
CH,CS

Hewlett-Packard Ltd.
Pontefract Road
NORMANTON, West Yorkshire WF6 1RN
Tel: 0924 895566
Telex: 557355
CH,CS,P

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDHILL, Surrey RH1 1PS
Tel: 0737 68655
Telex: 947234
CH,CS,E,P

GREAT BRITAIN (Cont'd)
Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, **SOLIHULL**, West Midlands
B90 4BL
Tel: 021 745 8800
Telex: 339105
CH,CS,E,P

Hewlett-Packard Ltd.
West End House
41 High Street, West End
SOUTHAMPTON
Hampshire S03 3DQ
Tel: 04218 6767
Telex: 477138
CH,CS,P

Hewlett-Packard Ltd.
Eskdale Rd.
Winnersh, **WOKINGHAM**
Berkshire RG11 5DZ
Tel: 0734 696622
Telex: 848884
E

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178
A,CH,CS,E,M,MP,P

Hewlett-Packard Ltd.
Nine Mile Ride
Easthampstead, **WOKINGHAM**
Berkshire, 3RG11 3LL
Tel: 0344 773100
Telex: 848805
CH,CS,E,P

IRELAND

NORTHERN IRELAND
Hewlett-Packard Ltd.
Cardiac Services Building
95A Finaghy Road South
BELFAST BT10 OBY
Tel: 0232 625-566
Telex: 747626
CH,CS

SCOTLAND
Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682
CH,CM,CS,E,M,P

UNITED STATES

Alabama
Hewlett-Packard Co.
700 Century Park South, Suite 128
BIRMINGHAM, AL 35226
Tel: (205) 822-6802
A,CH,M

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
P.O. Box 7700
HUNTSVILLE, AL 35807
Tel: (205) 830-2000
CH,CM,CS,E,M*

Arizona
Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2424 East Aragon Road
TUCSON, AZ 85706
Tel: (602) 889-4631
CH,E,MS**

California
Hewlett-Packard Co.
99 South Hill Dr.
BRISBANE, CA 94005
Tel: (415) 330-2500
CH,CS

Hewlett-Packard Co.
P.O. Box 7830 (93747)
5060 E. Clinton Avenue, Suite 102
FRESNO, CA 93727
Tel: (209) 252-9652
CH,CS,MS

Hewlett-Packard Co.
P.O. Box 4230
1430 East Orangethorpe
FULLERTON, CA 92631
Tel: (714) 870-1000
CH,CM,CS,E,MP

Hewlett-Packard Co.
320 S. Kellogg, Suite B
GOLETA, CA 93117
Tel: (805) 967-3405
CH

Hewlett-Packard Co.
5400 W. Rosecrans Boulevard
LAWNDALE, CA 90260
P.O. Box 92105
LOS ANGELES, CA 90009
Tel: (213) 970-7500
Telex: 910-325-6608
CH,CM,CS,MP

Hewlett-Packard Co.
3155 Porter Oaks Drive
PALO ALTO, CA 94304
Tel: (415) 857-8000
CH,CS,E

Hewlett-Packard Co.
4244 So. Market Court, Suite A
P.O. Box 15976
SACRAMENTO, CA 95852
Tel: (916) 929-7222
A*,CH,CS,E,MS

Hewlett-Packard Co.
9606 Aero Drive
P.O. Box 23333
SAN DIEGO, CA 92139
Tel: (619) 279-3200
CH,CM,CS,E,MP

Hewlett-Packard Co.
2305 Camino Ramon "C"
SAN RAMON, CA 94583
Tel: (415) 838-5900
CH,CS

Hewlett-Packard Co.
3005 Scott Boulevard
SANTA CLARA, CA 95050
Tel: (408) 988-7000
Telex: 910-338-0586
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
5703 Corsa Avenue
WESTLAKE VILLAGE, CA 91362
Tel: (213) 706-6800
E*,CH*,CS*

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
A,CH,CM,CS,E,MS

Connecticut
Hewlett-Packard Co.
47 Barnes Industrial Road South
P.O. Box 5007
WALLINGFORD, CT 06492
Tel: (203) 265-7801
A,CH,CM,CS,E,MS

Florida
Hewlett-Packard Co.
2901 N.W. 62nd Street
P.O. Box 24210
FORT LAUDERDALE, FL 33307
Tel: (305) 973-2600
CH,CS,E,MP

Hewlett-Packard Co.
6177 Lake Ellenor Drive
P.O. Box 13910
ORLANDO, FL 32859
Tel: (305) 859-2900
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
5750B N. Hoover Blvd., Suite 123
P.O. Box 15200
TAMPA, FL 33614
Tel: (813) 884-3282
A*,CH,CM,CS,E*,M*

Georgia
Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
ATLANTA, GA 30348
Tel: (404) 955-1500
Telex: 810-766-4890
A,CH,CM,CS,E,MP

Hawaii
Hewlett-Packard Co.
Kawaiahao Plaza, Suite 190
567 South King Street
HONOLULU, HI 96813
Tel: (808) 526-1555
A,CH,E,MS

Illinois
Hewlett-Packard Co.
304 Eldorado Road
P.O. Box 1607
BLOOMINGTON, IL 61701
Tel: (309) 662-9411
CH,MS**

Hewlett-Packard Co.
1100 31st Street, Suite 100
DOWNERS GROVE, IL 60515
Tel: (312) 960-5760
CH,CS

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Telex: 910-687-1066
A,CH,CM,CS,E,MP

Indiana
Hewlett-Packard Co.
7301 No. Shadeland Avenue
P.O. Box 50807
INDIANAPOLIS, IN 46250
Tel: (317) 842-1000
A,CH,CM,CS,E,MS

Iowa
Hewlett-Packard Co.
1776 22nd Street, Suite 1
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
CH,MS**

Kansas
Hewlett-Packard Co.
7804 East Funston Road, #203
WICHITA, KS 67207
Tel: (316) 684-8491
CH

Kentucky
Hewlett-Packard Co.
10300 Linn Station Road, #100
LOUISVILLE, KY 40223
Tel: (502) 426-0100
A,CH,CS,MS

Louisiana
Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
P.O. Box 1449
KENNER, LA 70063
Tel: (504) 467-4100
A,CH,CS,E,MS

Maryland
Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Telex: 710-862-1943
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
A,CH,CM,CS,E,MP

Massachusetts
Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (617) 682-1500
A,C,CH,CS,CM,E,MP,P*

Hewlett-Packard Co.
32 Hartwell Avenue
LEXINGTON, MA 02173
Tel: (617) 861-8960
CH,CS,E

Michigan
Hewlett-Packard Co.
4326 Cascade Road S.E.
GRAND RAPIDS, MI 49506
Tel: (616) 957-1970
CH,CS,MS

Hewlett-Packard Co.
1771 W. Big Beaver Road
TROY, MI 48084
Tel: (313) 643-6474
CH,CS

Minnesota
Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
A,CH,CM,CS,E,MP

Missouri
Hewlett-Packard Co.
11131 Colorado Avenue
KANSAS CITY, MO 64137
Tel: (816) 763-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100
A,CH,CS,E,MP

SALES & SUPPORT OFFICES
Arranged alphabetically by country

UNITED STATES (Cont'd)

Nebraska
Hewlett-Packard
10824 Old Mill Rd., Suite 3
OMAHA, NE 68154
Tel: (402) 334-1813
CM,MS

New Jersey
Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07652
Tel: (201) 265-5000
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
60 New England Av. West
PISCATAWAY, NJ 08854
Tel: (201) 981-1199
A,CH,CM,CS,E

New Mexico
Hewlett-Packard Co.
11300 Lomas Blvd.,N.E.
P.O. Box 11634
ALBUQUERQUE, NM 87112
Tel: (505) 292-1330
CH,CS,E,MS

New York
Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
A,CH,E,MS

Hewlett-Packard Co.
9600 Main Street
P.O. Box AC
CLARENCE, NY 14031
Tel: (716) 759-8621
CH

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
CH,CM,CS,E,MS

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
A,CH,CM,E,MS

Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 8th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
CH,CS,E*,M*

Hewlett-Packard Co.
250 Westchester Avenue
WHITE PLAINS, NY 10604
Tel: (914) 684-6100
CM,CH,CS,E

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 921-0300
A,CH,CM,CS,E,MS

North Carolina
Hewlett-Packard Co.
5605 Roanne Way
P.O. Box 26500
GREENSBORO, NC 27420
Tel: (919) 852-1800
A,CH,CM,CS,E,MS

Ohio
Hewlett-Packard Co.
9920 Carver Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
CH,CS,MS

Hewlett-Packard Co.
16500 Sprague Road
CLEVELAND, OH 44130
Tel: (216) 243-7300
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
962 Crupper Ave.
COLUMBUS, OH 43229
Tel: (614) 436-1041
Eff: Nov. 25, 1983
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
CH,CM,CS,E*

Hewlett-Packard Co.
330 Progress Rd.
DAYTON, OH 45449
Tel: (513) 859-8202
A,CH,CM,E*,MS

Oklahoma
Hewlett-Packard Co.
304 N. Meridian, Suite A
P.O. Box 75609
OKLAHOMA CITY, OK 73147
Tel: (405) 946-9499
A*,CH,E*,MS

Hewlett-Packard Co.
3840 S. 103rd E. Avenue, #100
P.O. Box 35747
TULSA, OK 74153
Tel: (918) 665-3300
A**,CH,CS,M*

Oregon
Hewlett-Packard Co.
9255 S. W. Pioneer Court
P.O. Box 328
WILSONVILLE, OR 97070
Tel: (503) 682-8000
A,CH,CS,E*,MS

Pennsylvania
Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
A,CH,CS,E,MP

Hewlett-Packard Co.
2750 Monroe Boulevard
P.O. Box 713
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